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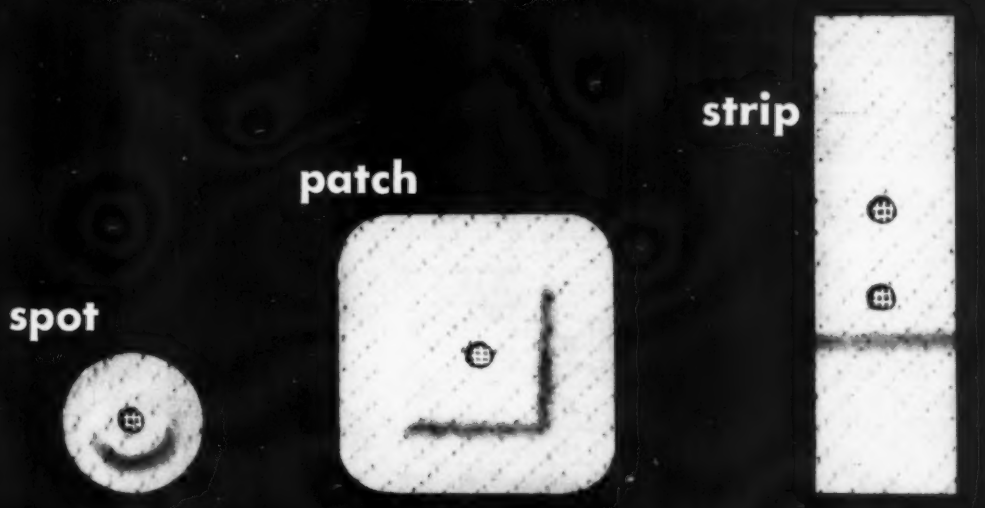

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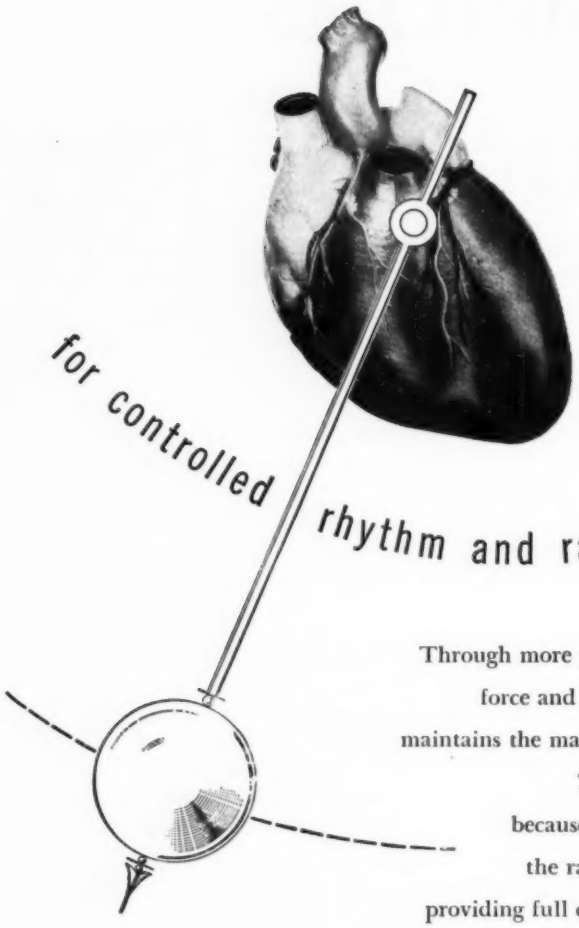

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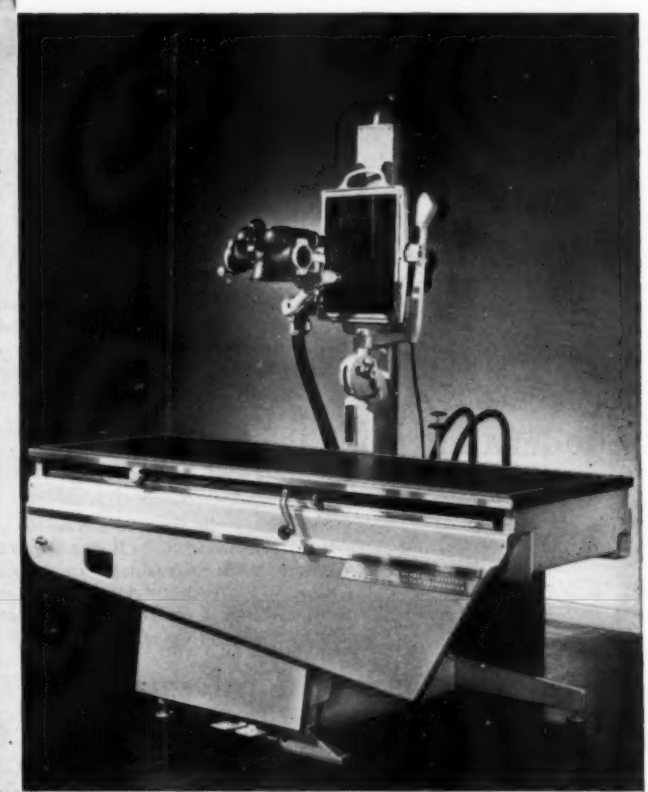

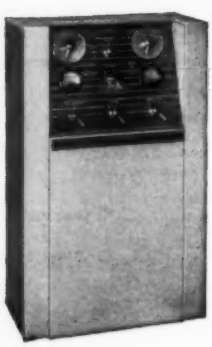

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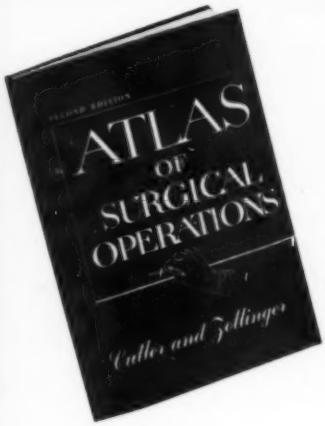

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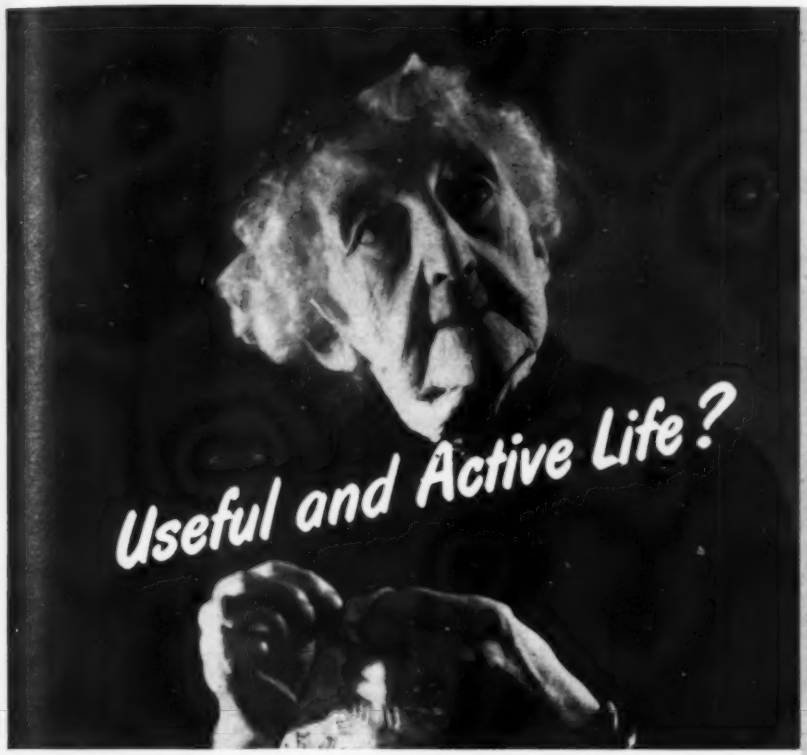

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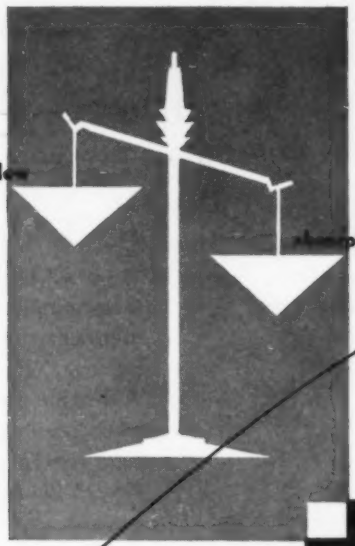

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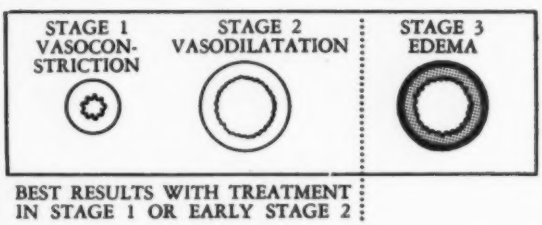

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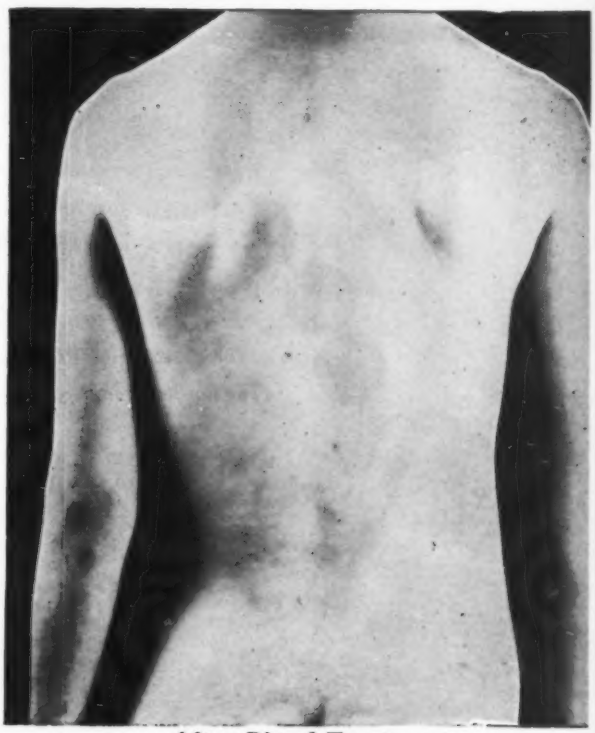

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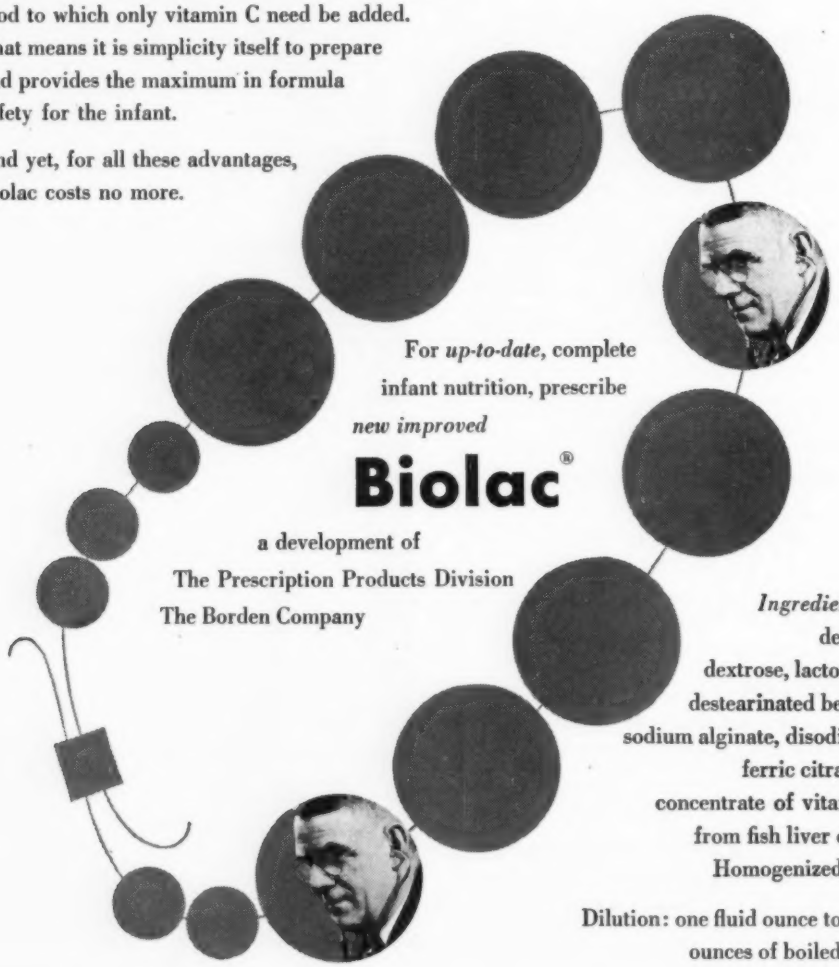

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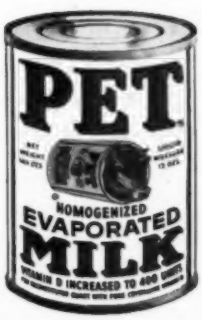

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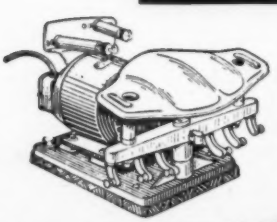

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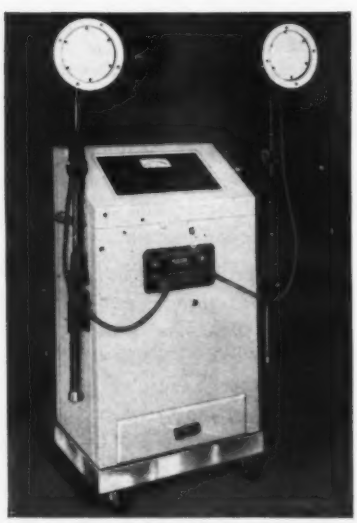

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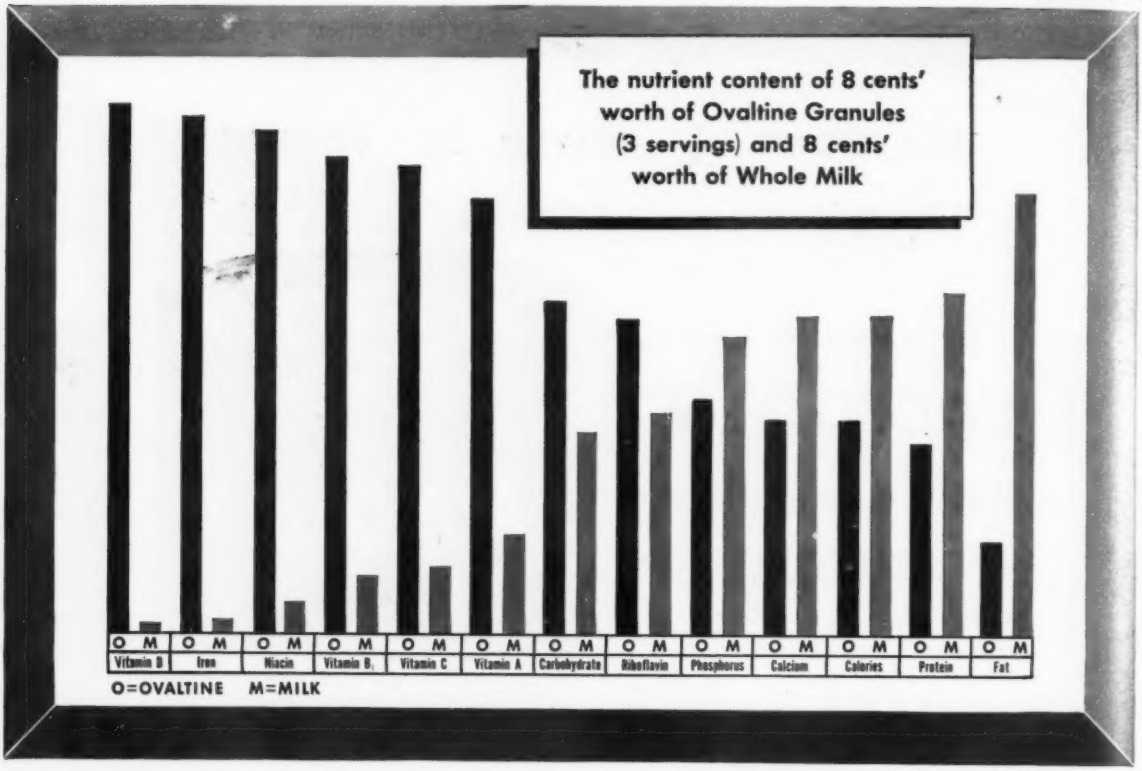

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A Neurophysiological Basis for an Osteopathic Interpretation Of Etiology in Internal Disease*

LEONARD GRUMBACH, Ph.D.
Department of Physiology, Des Moines Still College of Osteopathy and Surgery
Des Moines, Iowa

The intention of this paper is to discuss the neurophysiological background that would probably be necessary for a research program concerning the role of the osteopathic lesion in the etiology of internal disease. Perhaps this intention might seem rather anticipatory pending firm and objective demonstrations of the characteristics of the lesion and its role in internal disease. However, it is believed that a review of pertinent neurophysiological facts and theories may make more obvious the way in which this may be demonstrated.

As a point of departure I would like to take the definition of the osteopathic lesion as given by Korr[1] and analyze the neurophysiological mechanisms that are possibly involved in the production of the lesion.

3. The human organism, presumably because of its incomplete adaptation to the erect stance, is highly subject to anatomic and functional derangement of joints and their supports, especially the vertebral, pelvic, and other weight-bearing articulations.

4. These "errors" in weight-bearing unfavorably affect the structure and function of neighboring and distant parts of the body, thus initiating and contributing to pathological influences and processes. This complex of the articular disturbance and its associated phenomena has been designated as the *osteopathic lesion.*

5. The spinal lesion is associated with: (a) Tenderness or hyperesthesia of the paravertebral tissues and those overlying the vertebrae (skin, muscle, and connective tissue); (b) muscular changes—rigidity, sustained contraction (or contracture), ropiness, and lowered motor reflex thresholds; (c) autonomic changes, as reflected in textural changes of the supraspinous tissues, vasomotor changes, alterations in visceral and other autonomic functions; and (d) pain, which, when it occurs, is of the "deep" variety; it is rather diffuse and may be radiating or "referred."†

It is most likely that this definition of the lesion may not meet with complete agreement; nevertheless it was chosen as it is the only one that could be found which afforded a basis for a discussion of the underlying neurophysiological mechanisms of the osteopathic lesion. We see therefore that the phenomena associated with the lesion may be separated into four groups: (a) pain, when it occurs, and/or hyperesthesia and hyperalgesia, (b) reflex muscular contraction, (c) lowered motor reflex thresholds, and (d) autonomic changes. As a preliminary to a discussion of the possible neurophysiological mechanisms underlying these phenomena a tentative hypothesis which brings these diverse phenomena into a simple relation with one another will be offered. In this way pertinent neurophysiological data can be presented in a logical sequence as the various features of the hypothesis are discussed.

Korr[1] points out that "the disturbance of an articulation exerts its influence directly through the soft tissues which surround and support it . . . muscles, tendons, and ligaments on at least one side of that articulation are subjected to, and maintained at, excessive tension."

As the articular disturbance produces actual or impending damage to the surrounding soft tissues, the pain receptors whose function it is to signal such information to the central nervous system may be assumed to be stimulated by the mechanical changes produced by the disturbance. The main point of my hypothesis is that impulses from these same pain receptors are also the cause of all the other phenomena associated with the lesion. In this paper I will discuss the theoretical support of this hypothesis. Obviously this discussion will not "prove" the hypothesis. This can be done only in the laboratory, and, before any progress in establishing an osteopathic etiology of internal disease can be made, the source of the afferent impulses giving rise to the lesion phenomena must be located. However, before the search is started it is useful to have some idea as to what may be expected on the basis of what is already firmly established experimentally and clinically.

It has been repeatedly demonstrated experimentally and clinically that noxious stimulation gives rise to flexor reflexes of a protective nature and to activation of the sympathetic division of the autonomic nervous system as well as to pain. There is, moreover, no evi-

*Presented at the meeting of the American College of Osteopathic Internists, Eastern Study Group, Philadelphia, March 30-April 2, 1950.

†"The similarity between this complex and the classical referred pain pattern is obvious." This footnote was published in conjunction with the above quotation.

dence that stimulation of any other type of receptor can give these reactions directly, that is, without eventually involving the pain receptors. The main difficulties encountered by the hypothesis from a theoretical point of view are the fact that the muscles reflexly engaged as a result of spinal articular disturbances are, anatomically, extensor muscles rather than flexors and the explanation of the long enduring character of the lesion as evidenced by the stability of the motor reflex thresholds of the individual spinal segments.[2] However, even these difficulties can be handled theoretically. Whether the explanations of these phenomena have any validity can only be determined in the laboratory and by critically objective clinical research, but even if they should be proved invalid by this type of work, they will have been useful because they will have stimulated the production of this work.

PAIN

Since the pivotal feature of the osteopathic complex on our hypothesis is the stimulation of the pain receptors in the lesioned area, a logical place to begin a discussion of the neurophysiological events of which the lesion is probably comprised is with the subject of pain. Pain has been extensively studied for the past half-century, and, perhaps as a result of this extensive study, it has also been the subject of intense controversy which persists even now. This makes it difficult to explain phenomena involving pain dogmatically. Again, only constant recourse to the laboratory and clinical observation will settle these controversial issues. Since the osteopathic lesion is intimately related to pain, investigations as to the nature of the latter will very likely lead the way to the solution of some osteopathic problems, and, conversely, objective study of the lesioned area can offer some clues as to the peripheral events giving rise to pain. It will be impossible to discuss the subject at all adequately in this paper; however, the subject has been reviewed exhaustively by several authors,[3-7] and the reader is referred to these sources for a comprehensive survey of the subject.

At present there is complete agreement on several points concerning pain. It is now agreed, for example, that pain is a specific sensory modality having its own receptors and pathways in the peripheral and central parts of the nervous system. This view has not always been universally held, but there are now no proponents of the opposite view that pain is due to excessive stimulation of other types of receptors such as tactile receptors.[5] Pain is classified according to the site of origin of the impulses giving rise to the sensation: visceral and somatic, with somatic pain further classified into cutaneous and deep. Recently it has come to be accepted that these various categories represent nothing more than a geographical classification of the sites of origin of the impulses giving rise to the pain since there seems to be no essential difference in the mechanism by which pain sensations are produced on noxious stimulation of the aforementioned sites. Pain due to noxious stimulation of the skin can be more easily localized than pain in viscera; this is due primarily to a psychological difference, not to a radical difference in mechanism.

In the course of learning by experience we have considerable chance to link our visual mechanisms with superficial noxious stimulation while there is very little opportunity, if any, of doing the same when the noxious stimulation is deep or visceral. If our body walls were transparent, deep and visceral pain would be better localized.[6] Another point that served to support the view that the visceral pain mechanism was essentially different from the somatic has finally been satisfactorily explained in favor of a unified view of the pain mechanism. It was thought that the visceral pain mechanism must be different from the somatic because pain could not be aroused by stimuli which caused pain when applied to the skin. The adequate stimulus for the pain receptors in the viscera is distention; they have a relatively high threshold to stimulation by other kinds of changes: mechanical, such as crushing or pinching; chemical; and thermal, changes which easily stimulate when applied to the skin. From a biological point of view this differential sensitivity to types of stimulation is not unexpected. In the normal course of events the viscera are not usually subjected to the same type of energy changes that the skin is; hence it would serve no useful purpose for the pain receptors to possess a sensitivity to stimuli that they would not be likely to receive. They are sensitive to the one type of tissue-damaging change that frequently does occur in the viscera, namely overdistention.

Deep somatic and visceral pain has a tendency to spread into other parts of the body from the primary site of pain or to be referred to parts at a distance from the site of noxious stimulation. In fact the pain from areas of reference or the pain that has spread may dominate the primary pain or persist after the primary pain has disappeared.[5] This tendency is also shared by cutaneous pain although to a relatively lesser degree.[5] The radiating or referred pain is usually more unpleasant subjectively than the primary pain. The skin in the area to which the pain spreads or is referred usually exhibits hyperalgesia. Tenderness may also be found in deep tissue areas which, however, may not correspond with the cutaneous areas of hyperalgesia.[7] Finally, reflex contractions of flexor muscles and vasomotor and sudomotor changes may also occur in the affected areas. If the reflex contractions are prolonged, the muscles may become painful themselves.[3]

Most of the controversy that exists today among students of the subject arises when an explanation of these phenomena is attempted. As Sinclair, Weddell, and Feindel[7] have pointed out, there are two distinct, opposing beliefs prevalent concerning the nature of the mechanism producing referred pain. One belief is that the mechanism lies in the central nervous system; the other is that it lies in the periphery. They have attempted to resolve, at least partly, the controversy by introducing a third theory which is based on recent neuroanatomical researches into the nature of the peripheral pain pathways. These researches indicate that some of the axons that constitute these pathways are branched, one branch ending at a considerable distance from the other. Sinclair, Weddell, and Feindel point out that this fact cannot be ignored in explaining referred pain and the phenomena associated with it, even if it should prove not to be the sole basis. As they say, the theorists of the opposing schools of thought have a tendency to ignore certain facts which upset their particular theory and support an opposite one. Since the phenomena associated with true and referred pain are similar, if not identical, with those associated with the osteopathic lesion, this problem deserves very close attention. Until the controversy is clearly resolved by experiment, and, as I have said before, a critical study of the osteopathic lesion may aid in this resolution, adherence to any particular school of belief is inadvisable. The history of science shows that, often, when a controversy is as prolonged as this particular

one has been, both sides are partly right. Since my aim is to present a basis for future research, I shall borrow from all schools of thought in the ensuing discussion of referred pain and its associated phenomena.

If the site of noxious stimulation is locally anesthetized, the primary pain and referred pain with its associated phenomena will both disappear as the impulses giving rise to this train of events will be blocked in their passage towards the central nervous system.[3,5] When the area of reference alone is anesthetized the pain may or may not disappear according to the various results obtained with this procedure that have been reported in the literature.[7] Hyperalgesia in the area of reference, on the other hand, will disappear even though the referred pain does not. The observers who report the disappearance of referred pain after procaine infiltration believe that this indicates that the referred pain is due to a peripheral mechanism. Those who were unable to confirm these findings believe that referred pain is a central phenomenon occurring either in the spinal cord or in the brain.[7] Sinclair, Weddell, and Feindel[7] believe, on the other hand, that referred pain is first a central and then a peripheral phenomenon, or, as they say, ". . . in the first stages of their development, pain and tenderness in the area of reference are, so to speak, an illusion, but rapidly become a reality, which may persist independently for some time after the original cause has been removed."

All the various central mechanisms proposed to explain referred pain agree that it is a "misinterpretation mechanism" resulting from an integration of the pain messages occurring between the pain receptors and the highest level of the central nervous system reached by these messages.[7] The exact nature of the integrative mechanism is the point of disagreement. Ruch[9] proposes a convergence mechanism in the gelatinous substance of Rolando where the spinothalamic tract axons originate. Some of the neurons in this pool receive more than one afferent fiber from the periphery. Those neurons that receive both somatic and visceral afferents send impulses to the highest level of the central nervous system which give rise to sensation that is projected only to the site of the termination of the somatic fibers. Thus, even though this type of spinothalamic neuron is stimulated by impulses arriving over the visceral afferents, the pain will seem to arise in a somatic area.

Wolff[3-5] supposes that referred pain is due to a facilitation mechanism, or "spread of excitation," occurring in the spinothalamic neuron pool. The exact manner in which this occurs, however, is not made clear.[7] At any rate, when the excitation spreads from spinothalamic neurons being excited by impulses arriving over visceral afferents to neurons in the pool that receive afferents from the somatic areas of this segment, the pain sensation aroused by the impulses from the latter neurons will be projected to the areas from which they are usually stimulated in the ordinary course of events.

According to Sinclair, Weddell, and Feindel[7] the integrative process giving rise to referred pain occurs in the peripheral pain pathway itself. Referred pain on their theory is due to the branching that is known to occur in axons subserving pain. Certain primary pain afferents send one branch of axons to a viscus and the other to some muscle or skin in the same segment. An impulse ascending the visceral branch eventually arouses a pain sensation which is projected to that part of the area served by this particular neuron with which the highest level of the nervous system has had the most experience, namely the somatic. When the impulse ascending the visceral branch reaches the bifurcation in the axon it figuratively divides; that is, it simultaneously continues its central course and also redescends the somatic branch out to the periphery. Its effect there will be described in the next paragraph. It is possible that referred pain may be due to all of these mechanisms or only to one. So far the crucial experiments that would enable one to choose between these hypotheses have not been made.

Wolff[5] further believes that hyperalgesia and deep tenderness in the area of reference are also explicable by the facilitation mechanism described above. For example, as a result of an intense, prolonged inflow of impulses due to noxious stimulation of a viscus the spinothalamic neurons of the same segment which only receive fibers from the somatic areas of that segment will have their excitability increased as a result of the "spread of excitatory effects of sustained noxious stimulation"[5] so that they now are able to discharge impulses in response to an inflow of afferent impulses from the somatic area which ordinarily would be too weak to bring about a response. Ruch[9] agrees with this mechanism as an explanation of hyperalgesia.

Sinclair, Weddell, and Feindel,[7] on the other hand, believe that the hyperalgesia is due to a peripheral process that results when the nerve impulses redescending the somatic branch of the bifurcated axon reach the terminations of this branch. According to them the impulses cause the liberation of some metabolite which can excite the endings or which at least lowers the threshold of the receptors. If the action of the metabolite is prolonged it may damage the endings. Branches supplying deep tissues liberate the metabolite upon antidromic stimulation as just described, and this causes deep tenderness. In a muscle the metabolite may stimulate receptors which evoke reflex contractions of the muscle. According to their theory each viscus is represented in the muscles and skin by pain endings of fibers which are branches of certain of the visceral pain afferents. Accordingly, there is the possibility that somatovisceral reflexes may be caused by antidromic stimulation of the visceral branches as a result of noxious stimulation of the endings of the somatic branches of these neurons. They believe that the phenomenon of counterirritation is explicable on this basis.

The theories that explain referred pain as due to a peripheral mechanism assume either that a chemical substance is liberated in the area of reference either by antidromic stimulation or by reflexly aroused impulses as a result of noxious stimulation of a viscus or that vasoconstriction occurs in this area. In either case the somatic pain receptors there are stimulated in consequence. For example Pollock and Davis[10] believe that referred pain is due to a hormone or metabolite liberated at sympathetic endings which in turn stimulates sensory pain endings belonging to the cerebrospinal system located in this region. The sympathetic discharge which liberates the metabolite is reflexly aroused by noxious stimulation in some viscus. Lewis[6] has demonstrated that hyperalgesia in and surrounding an injured area of skin is due to a chemical substance liberated at the terminals of branches of axons which have other endings in the injured region. It has been suggested[11] that the chemical substance is a metabolite liberated as a result of prolonged activity.

Penfield[12] believes that by an axon reflex in the sympathetic system a vasoconstriction occurs in the

area of reference when a viscus has been stimulated. The somatic pain endings in the area are stimulated as a result of the reduction in blood flow thus caused. Vasoconstriction in the area of reference has been actually observed,[13] but whether or not the vasoconstriction is the cause of the pain has not been unequivocally demonstrated. White[14] in a discussion with Penfield states that he does not believe that visceral "axon reflexes play any significant role in visceral pain." Roberts[15] believes that the vasa nervorum may be reflexly constricted by visceral noxious stimulation so that nerve trunks rather than receptors may be made ischemic and that this might be the mechanism of referred pain. These processes may occur, but they cannot be the sole explanation of referred pain, because, as Sinclair, Weddell, and Feindel[7] point out, these theories cannot explain the spread of pain into an anesthetized area which has been demonstrated.[5]

Furthermore, before these theories can be accepted even as partly correct, a certain number of anatomical and physiological problems would have to be settled. These are worthwhile mentioning because certain clinical manifestations may be explicable on the basis of these structural and functional mechanisms if they can be unequivocally established. One problem that is very unsettled is the question of axon reflexes. As far as the skin is concerned there seems to be no doubt that there is extensive branching of the termination of the pain pathway.[6,7,16] The theory of Sinclair, Weddell, and Feindel[7,8] depends on more proximal branching of the pain pathway as well so that branches of an axon could be distributed between skin, deep somatic tissues, and viscera. By assuming that such branches exist, they have been able to develop a theory concerning referred pain and its associated phenomena which satisfactorily explains most of the known facts. However, they state that the anatomical basis for the assumption is still not worked out.

Still further unsettled is the problem of the vasomotor axon reflex in which the pain axon is supposed to have an efferent, vasodilator branch innervating the arterioles or capillaries in the area containing the ending of the pain axon. Although the functional relationship between local vasodilatation and noxious stimulation of a cutaneous area is well established, its anatomical substrate has never been definitely demonstrated as pointed out in Tower's discussion of a paper by Hinsey.[17] As Tower says, if the anatomical relationship could be proved, "it would give countenance to the consideration of intrinsic visceral reflexes on a unineuronal basis." Instead of, or perhaps in addition to, an axon reflex connection between sensory and autonomic fibers, there may also exist monosynaptic pathways with the cell station in the sympathetic ganglia[18] between visceral pain fibers and postganglionic vasomotor fibers. This reflex would however be constrictor rather than dilator as in the axon reflex. Again, even though this idea was first proposed 40 years ago, it has not yet been conclusively demonstrated. Even the existence of segmental, reflex vasoconstrictor pathways still has no definite anatomical basis. The central processes of the primary afferents subserving pain do not end directly on the cells of the lateral horn, as the following quotation from Fulton[19] indicates: "The majority of dorsal root fibres which actually enter the dorsal horn terminate upon internuncial neurons in the intermediate grey matter of the cord; in the thoracic levels, however, none appear to terminate upon the cells of the lateral horns." Wolff[20] infers a connection between the pain afferents and the cells of the lateral horn of the segment of entrance by way of collaterals of the spinothalamic neurons. The neuroanatomical grounds for this inference are obscure.

There also are numerous physiological problems that have not been fully settled. Certain theories of referred pain suppose that vasoconstriction in the region of pain receptors stimulates them. This supposition is also frequently evoked to explain causalgic pain. However, it is now evident that causalgia may be accompanied by vasodilation instead of constriction or by neither one.[21] Also the conditions under which vasoconstriction can stimulate pain receptors have not been established. The theories which implicate a metabolite as causing the pain suffer from the fact that the metabolite has not been identified as yet. Lewis[6] believes that histamine or a histamine-like substance causes the erythralgia in the hyperalgesic area but that the pain producing substance is different. Acetylcholine has also been mentioned as a possibility.

In view of the fact that pain is not a constant feature of the osteopathic lesion and that deep tenderness and hyperesthesia is more often encountered, it will be profitable to summarize again the prevalent knowledge of the relationship between these phenomena. Wolff[3] and his collaborators distinguish two types of hyperalgesia, primary and secondary. Primary hyperalgesia is due to local chemical and physical changes in the area of noxious stimulation which lower the threshold of the pain receptors. This type of hyperalgesia is seen, for example, in areas of inflammation. Secondary hyperalgesia is seen in areas other than the primary site of noxious stimulation. When this secondary area is stimulated normally it seems to be painful and tender because the impulses from the pain and, possibly, touch and temperature receptors reach spinothalamic neuron pools which have been facilitated by bombardment from the pain receptors in the primary site of noxious stimulation. It would be expected, therefore, that procainization of either the secondary area or of the primary area would cause this type of hyperalgesia to disappear. Wolff[3] has shown that this is the case. In addition, he has shown that clinically the hyperalgesia may occur with or without pain in the secondary area, and that it also may occur without any marked pain from the primary site of noxious stimulation or after the latter has ceased being noticeable. This is more likely to be true of deep and visceral pain than cutaneous pain. We have seen, on the other hand, that Sinclair, Weddell, and Feindel[7] believe that secondary hyperalgesia is due to a metabolite released in the area of reference by antidromic stimulation from the primary site of noxious stimulation. However, even if this should prove to be true the relationships just described will be still valid; the only difference would be the explanation to account for them.

REFLEX MUSCULAR CONTRACTION

Reflex muscular contractions in the lesioned area are a common feature of the osteopathic lesion complex. It is my hypothesis that these reflex contractions are flexor reflexes which are evoked by the same noxious peripheral stimulation which causes the pain also associated with the lesion. Pain is the warning signal in consciousness that a tissue-damaging process exists in the periphery. The flexor reflex is a mechanism for withdrawal of the tissue which is being injured from the noxious stimulus or for protecting the tissue against further injury.[18] Adrian[22] points out that the

flexor reflex pathway is structurally and functionally organized to carry out this function with great efficiency. In contrast to the spinal postural mechanism where precise localization of effect is necessary and which is achieved by means of a monosynaptic pathway, the flexor reflex pathway contains at least one additional synapse, and usually more, at internuncial neurons. As a result of divergence "the afferent discharge has access to a whole network of internuncial neurones," if necessary, to enable the organism to withdraw from the damaging stimulus at a rate and in a manner commensurate with the strength of the noxious stimulus. Thus, as Adrian says, "if the danger signals persist and increase, the avoiding movements must become more powerful, involving more and more muscles." In the local proprioceptive mechanism, on the contrary, it is found that the motor discharge is localized to a definite channel and is a fairly exact copy of the afferent discharge, whereas the flexor motor discharge may leave by various efferent paths and the discharge, largely due to internuncial activity, is no longer a copy of the afferent discharge. On reflection it is obvious that the two mechanisms are most efficiently adapted to the functions they perform for the organism as a whole, and no possible overlapping or interchange between the two would be expected. The following quotation from Lloyd[23] bears precisely on this point, and since I cannot improve on his statement I will quote it in full.

> The myotatic reflex pathway, and its associated projection through Flechsig's tract to the cerebellum, the vestibular and reticular systems and the dominant descending long spinal reflex pathways all have several dynamic properties in common. They are characterized by the large size, high conduction velocity and relative uniformity of their constituent nerve fibers, and they are all primarily concerned with the transmission of postural activity. In contrast, other reflex, afferent and motor systems, those mediating flexor reflexes, cutaneous sensitivity and voluntary motor activity are characterized by diversity of fiber size, with the largest fibers not overlapping to any great extent the range present in the postural mechanisms. In general too the synaptic connections of these systems are more devious and complex than those of the postural mechanisms. One is tempted to speculate on the functional significance of these facts for the integration of movement in the intact animal. It seems quite plausible that the function of the high velocity systems set in parallel with other paths is in part to antecede those paths in temporal sequence of action and so to adjust posture to a state appropriate to the initiation of movement in readiness for the actual performance of that movement.

As we have seen, it is commonly stated that the flexor reflex is aroused by painful stimulation; however, "final justification for a specific relationship is not yet available."[23] Painful impulses are known to be carried by fibers of two different size groups: the delta fibers of the A group of fibers and C fibers. In addition Gasser[24] believes that some fibers larger than delta fibers in cutaneous nerves also can carry impulses that will give rise to the sensation of pain. The delta group, moreover, does not exclusively subserve the modality of pain, but also touch.[25] Similarly, the flexor reflex can be evoked by delta fibers and also by larger fibers of the A group as well as by fibers of the C group. Thus, although it has been shown that undoubtedly pain impulses evoke the flexor response, it cannot yet be decided whether tactile impulses carried by delta fibers or pressure and temperature impulses carried by the larger A fibers also can evoke the response or not. Kugelberg,[26] on the other hand, has shown that, in cutaneous nerves of humans, the largest fibers are purely tactile and cannot evoke the flexor reflex. He was able to demonstrate a double reflex response to noxious stimulation and sufficiently strong electrical stimulation the individual latencies of which were indicative of delta and C fiber conduction and which were identical with the latencies for "first" and "second" pain. He concluded that the afferents for each flexor reflex are partly, at any rate, concerned with the two pain responses.

The following experiment of Porter and Taylor[27] would seem to indicate that there is some chance that other sense modalities, excluding the proprioceptive, besides pain might play a role, at least under certain conditions, in evoking flexor reflexes. They stimulated a sensory nerve in the limb of a cat (whose spinal cord had been transected) with electrical shocks just strong enough to barely elicit a flexor response of tibialis anticus in the same limb. Then mild stimuli such as hot water, ice water, air currents, and light stroking were applied to the skin of the leg. When this was done the reflex contractions being evoked by electrical stimulation became much stronger. The stimuli to the skin elicited no reflex motor response when applied alone. However, as Lloyd[23] points out, when a sensory trunk is electrically stimulated "fibers of many sensory modalities are activated together in unnatural combination," and under these circumstances the reflex discharge so produced has an anatomical rather than a functional significance. In a more natural situation in humans Denslow[2] was able to evoke reflex contractions in a low motor reflex threshold segment by light tactile stimulation of the skin of that segment. If we assume the reflex to be flexor and the neurons facilitated to be internuncials of the flexor reflex pathway, we find agreement between the experimental situation of Porter and Taylor[27] and the clinical observations of the lesioned area by Denslow,[2] and also the possibility that the mechanism of each is similar. Further work, according to Lloyd,[23] on the relation of sense modalities and reflex effect needs to be done to advance our knowledge of the functional organization of the spinal cord. It is obvious that such researches are particularly related to the advancement of the osteopathic concept.

The role of noxious stimulation of the skin and soft tissues of a limb in evoking flexor reflexes of the limb is well known. More pertinent to our present purpose, however, would be a knowledge of the nature of the reflex spasms produced by noxious stimulation of articular surfaces. The physiology of movable joints has recently been exhaustively reviewed by Gardner.[28] All of the relevant clinical and experimental work reviewed by him indicates that the reflex response to noxious stimulation of a joint is always flexor. In chronic arthropathies in humans, the prolonged inhibition of extensors resulting from long maintained flexor reflexes by virtue of the operation of the principle of reciprocal innervation leads to actual atrophy by disuse of the extensors. In addition to free pain endings of articular nerves histological studies have revealed that some nerve fibers terminate in complex endings in joint tissues. The nerve fibers that end in this way are of larger diameter than those that end freely and undoubtedly subserve pain only. Hence the fibers ending in complex end organs of the Ruffini type can be stimulated electrically by themselves as they have a lower threshold than the smaller fibers subserving pain. In spinal animals stimulation of these nerve fibers consistently evokes flexor reflexes. However, in decerebrate animals such stimulation produced

a variable response, if any. At the present time the function of these endings is in doubt, as is the specific manner in which they are normally stimulated. The myelinated fibers to which the complex endings give rise have been traced through the dorsal funiculi to the medulla oblongata; they also give off collaterals to internuncial neuron pools of the spinal gray matter en route. The reflex discharge over the ventral root evoked by stimulating these fibers is of the multineuron arc discharge type. Gardner[28] lists as possible normal stimuli of these endings compression of the joint capsule particularly during flexion and tension and pressure changes in the joint capsule and synovial fluid respectively. He states that the current view is that these receptors participate in reflexes that "operate in phasic mechanisms, such as locomotion." Others have speculated, however, that they may operate in the reflex limitation of motion to protect the joint.

As has already been pointed out, an apparently serious objection to this hypothesis arises from the fact that the muscles reflexly engaged by the noxious influence of spinal articular disturbances are, anatomically, extensors of the vertebral column and not flexors. This objection, however, is not fatal. In the first place nearly all of the experimental work on the flexor reflex has been done on the limbs of four-footed animals. In this situation avoidance of further injury when a part of the limb is noxiously stimulated would obviously be most expeditiously achieved by withdrawal of the part. In man noxious stimulation of the viscera is accompanied as is well known by reflex contractions of the abdominal muscles which are flexors of the trunk. The biological purpose of this reflex is to allow the omentum to descend and cover the site of the pathological process and also to produce immobility which assists the walling off process.[18] In order to achieve splinting of the trunk, reflex contraction of the extensors of the trunk may be expected to occur as well as reflex contraction of the flexors. That this is probably so is indicated by the fact that noxious stimulation of the dura leads to retraction of the head by reflex engagement of the neck muscles, which, anatomically, are extensors.[18]

In the second place it would indeed be odd if noxious stimulation of spinal articular surfaces produced reflex responses that were functionally different from those produced by stimulating limb joints in the same way. The problem of functional classification of the trunk musculature is one of paramount importance for osteopathic theory and hence deserves intensive experimental and clinical attention.

LOWERED MOTOR REFLEX THRESHOLDS

This aspect of the osteopathic lesion has been investigated experimentally by Denslow and his collaborators.[2,29,30] They showed that the amount of pressure that has to be applied to the spinous process to produce a threshold reflex contraction of the erector spinae muscles differs in various segments. The segments with the lowest thresholds were those that showed other signs of the osteopathic lesion, and conversely segments diagnosed as lesioned had lower reflex thresholds than normal segments. They also studied the thresholds for excitation of segments other than the one to which the pressure stimulus was applied and found that there was much more spread *"to* lesioned segments than *from* lesioned segments."[30] Furthermore procainization of the spinous processes of lesioned segments did not interfere with the spread of excitation from other unprocainized spinous processes, although it naturally increased the reflex threshold for stimuli applied to the procainized process. This demonstrates that the facilitated state of the segment is due to a central, rather than a peripheral, process, and Denslow, Korr, and Krems[29] state that ". . . low threshold segments are those in which a relatively large portion of the motoneurons are maintained in a state of facilitation due to a chronic bombardment by impulses from some unknown source. Presumptive evidence indicates that the facilitating impulses arise from segmentally related structures."

My hypothesis is that the internuncial systems of the dorsal horn and intermediate gray regions are those that are maintained in the facilitated state and that one possible source of impulses maintaining this state is the pain and possibly other nonproprioceptive receptors in the soft tissues surrounding the articular disturbance. This hypothesis is in keeping with some additional observations made by Denslow. For example, he and his collaborators[29] found that the low motor reflex threshold segments seemed to have lower pain thresholds than high threshold segments. Furthermore, light tactile stimulation frequently caused reflex firing of the erector spinae muscles in low threshold segments, whereas it did not in segments with high thresholds.[30]

Denslow[2] further observed that in human subjects the thresholds of individual segments whether they were high or low remained fairly constant over periods of time as long as several months. Obviously it is a matter of great importance to elucidate the factors producing this enduring state of facilitation. In the previous paragraph the hypothesis was advanced that the facilitated state might result from a tonic afferent discharge from pain or other nonproprioceptive receptors. Korr,[1,30] on the other hand, believes that the source of the chronic afferent bombardment is the proprioceptors in muscles, tendons, and ligaments of the lesioned area. However, attention is called to the quotation from Lloyd[22] in the previous section. Neither hypothesis has as yet been subjected to experimental verification. In the meantime it might be worthwhile to ask if these two hypotheses exhaust the field of possible hypotheses that might be formulated on the basis of current neurophysiological knowledge. The answer to this question would be in the negative as the following material will illustrate.

The two hypotheses just mentioned which attempt to relate the enduring facilitation of motor or internuncial neurons to a segmentally related tonic afferent discharge have in common the presumption that the receptors whichever they may be are excited in a normal fashion by stimuli arising from the articular disturbance initiating the osteopathic lesion complex. Here we are supposing that, as a result of a disturbance to "the symmetrical inflow of impulses which occurs when the body is in a normal resting position," a central activity is caused "which continues until the balance is restored by the removal of the disturbing stimulus."[22] It is possible, however, that the disturbance of the afferent pattern can arise as a result of interference with the normal functioning of parts of the peripheral pathway other than the receptors. For example as a result of mechanical derangement the blood supply of a nerve trunk might be altered to such an extent that normal function will be interfered with. As we shall see below this could cause a disturbance to the symmetrical inflow impulses with its consequent alteration of central activity.

Lorente de Nó[31] has recently studied in detail the manner in which certain agents reduce the membrane potential and cause the nerve fiber to discharge nerve impulses spontaneously or following normal activity after they have reduced the membrane potential by a certain amount. The causes of this spontaneous rhythmic discharge which are of interest here are: lack of oxygen, increased concentration of potassium ions outside the nerve fiber, and lack of calcium ions outside. In the case of discharge as a result of anoxia, the discharge ceases on readmission of oxygen. In the case of spontaneous discharge due to lack of calcium, increasing the concentration of carbon dioxide will stop the discharge as well as increasing the calcium concentration. He also found that once the process is initiated it is self-sustaining unless something is done to increase the membrane potential back to its normal level; if this is not done the process continues until the membrane potential is lowered to the point where the nerve becomes inexcitable. If the membrane potential remains low for some time as a result of the action of these depolarizing agents, the block to conduction of nerve impulses is irreversible.

Bronk[32] has studied extensively the effect of alterations in the chemical environment of nervous tissue *in situ*. He found that oxygen and calcium lack had effects on intact nerve similar to those that Lorente de Nó found for isolated nerve. Bronk emphasizes the fact that nerve cells can conduct impulses in the absence of oxygen, that is, still carry out their characteristic function in the body—in fact this ability is increased and out of control—but that ultimately oxidative energy is required to maintain the organization of the nerve cells to a degree if they are to continue to function. He also found that certain parts of the nervous system are more susceptible to ischemia than others but that they all showed enhanced activity as a result of anoxia for a time before a block in conduction occurred. He concludes with a statement which is particularly relevant.

> The units of the nervous system are in a state of dynamic equilibrium which is maintained at the expense of energy derived from materials supplied by the blood. An increase in the activity of these units increases the demands upon the circulation: alterations in the composition of the blood, on the other hand, profoundly influence the organization of the several parts of the neurone and thereby modify its activity. In terms of such a conception of the dynamic properties of the individual nerve cells we can proceed toward a better understanding of the relations of the nervous system to its blood supply.

The supposition is commonly made that, when there is a spontaneous discharge of relatively high frequency or when there are multiple discharges induced by the hyperexcitability of anoxia in place of what normally would be single impulses, this increase in afferent discharge merely produces additive effects. It is worthwhile to consider, however, the possibility whether this abnormal type of afferent discharge may not produce a qualitatively different type of central activity rather than merely a change in magnitude of the activity. As we shall now see the probability that this is so is not inconsiderable. This indicates the possibility that the mechanical derangement in the lesioned area might have different effects depending on whether pain receptors or nerve trunks or both were stimulated. This point at any rate deserves clinical and experimental attention.

Information concerning the outside world or orders from the central portion to the effector organs is conveyed by a system of communication that engineers call pulse frequency modulation. Information regarding differences of intensity of stimulation or magnitude of effect required are conveyed by alteration of the frequency of the nerve impulses making up the message. Furthermore, on the sensory side, only information concerning changes in intensity of stimulation is signalled; if the stimulation is maintained for any time the frequency of receptor discharge falls off more or less rapidly to zero. We would expect therefore that prolonged, repetitive discharge of the receptors or of their nerve trunks as in anoxia which was maintained for some time would lead to the transmission of a large amount of misinformation to the central nervous system. Walter and Walter[33] performed the following experiment which reveals that this is so. The skin on the back of a frog is lightly touched with a fine glass needle; this hardly arouses the frog's attention. However, when the needle is made to vibrate 100 times a second the frog responds with a startled leap even though the needle is touched to the back with the same pressure as before. An oscillographic examination of the nerve fiber of the tactile receptor shows in the first case a brief burst of impulses whose initial frequency is proportional to the pressure with which the needle is applied to the back. The frequency soon drops to zero even though the pressure is steadily applied. In the second case the fiber conducts impulses in synchrony with the vibration of the glass needle. This frequency is maintained as long as the needle is in contact with the back. The frog obviously interprets this stimulus as a very strong pressure which is steadily increasing in intensity.‡ Walter and Walter[33] have also used repetitive stimulation to study the mechanism of sensation in humans. They used a stroboscopic lamp whose flash rate could be controlled. They found that illusions, hallucinations, somatic effects, and emotional changes could be induced at appropriate frequencies of photic stimulation. Steady illumination of the same intensity does not produce these effects.

There is, therefore, the possibility that deep and visceral receptors and peripheral nerve pathways might, by responding with prolonged, high frequency discharges as a result of anoxia or other depolarizing agencies, "misinform" internuncial and motoneuron pools which in turn would respond in an inappropriate way; and this might occasionally lead to long maintained vicious circles.

In the normal course of events the actions of effector cells are constantly influencing and stimulating certain receptors, such as the proprioceptors, pressure receptors, and so on. That is, in the periphery there is normally interaction between efferent neurons and sensory neurons only by way of the effector cells and receptors. Recently interactions between neurons at regions other than the synapse have been demonstrated, and the possibility is good that such mechanisms of interaction as this can play a role in the causation of the osteopathic lesion and its associated phenomena. The extrasynaptic regions of interaction between neurons act, in effect, like an artificial synapse, and the name, "ephapse," has been given to these regions. The interaction that can occur between neurons has been used

‡Cattell and Hoagland in a discussion of a paper by Bronk[34] stated that in a similar experiment they did not get any response from the frog. They were attempting to prove that pain was a specific sensory modality and did not arise from intensive stimulation of tactile receptors. They used air jets at a frequency of 300 per second.

as a tool in the study of synaptic transmission; hence it is not surprising that there is now a fairly extensive literature on the subject of ephaptic mechanisms. Grundfest[35] has given a recent summary of this work. Only a few relevant facts will be mentioned here.

If we consider two adjacent fibers in a nerve trunk we will find that in spite of the insulating material around the fibers, the passage of a nerve impulse in one of these fibers will produce changes in excitability in its inactive neighbor. Normally the increase in excitability occurring in the inactive fiber as a result of this passage of the impulse is only about 20 per cent of threshold. If the resting excitability of the inactive fiber is now increased sufficiently by the action of suitable depolarizing agents, the inactive fiber will begin to discharge an impulse every time an impulse in the adjacent fiber passes by the ephapse.[36]

We can see then the possibility of stimulation of sensory nerve fibers coursing in a nerve trunk by efferent impulses being transmitted in motor nerves. If the blood supply of the nerve trunk is defective, for example, and if the fibers are thereby suffering from oxygen lack, the membrane potential of these fibers will be reduced. As we have already mentioned if the reduction in potential is sufficiently great the fibers will discharge impulses spontaneously. But we now can also see the possibility of aberrant impulses arising even if the degree of anoxia is not sufficient to cause such a spontaneous discharge. The depolarization in this instance will cause an increase in excitability such that the passage of impulses in neighboring fibers will cause the discharge of impulses in inactive fibers. Just such a mechanism as this has been postulated by Doupe, Cullen, and Chance[37] to explain the peculiar qualities of causalgic pain. According to them efferent sympathetic impulses stimulate the sensory pain fibers in the injured region of the nerve trunk. This explanation fits the facts of the causalgic syndrome better than the hypothesis that the pain fibers or pain endings discharge spontaneously as a result of vasospasm caused by the efferent sympathetic discharge. For example, crises of intense pain are frequently accompanied by vasodilation in the region from which the pain arises.

Granit, Leksell, and Skoglund[38] have investigated this matter experimentally in cats. They found that sensory fibers are more easily stimulated by efferent impulses in a region of injury than vice versa. They believe that the reason is that sensory fibers have a lower threshold and less ability to resist stimulation (a process called accommodation) than motor fibers. Significantly the unmyelinated pain fibers (C fibers) show hardly any accommodation at all. These relations have also been found to be true for man as well as the cat. Kugelberg[39] studied the effect of reversible nerve injury in man. He produced what he calls "trigger zones" (discharging lesions) in nerve trunks by cutting off the blood supply to them with a sphygmomanometer cuff. During the ischemia the trigger zone discharges spontaneously as described previously. After the ischemia there is first a period during which the spontaneous discharge comes in bursts which is succeeded by a period of high excitability without spontaneous discharge. In the latter period nerve impulses passing in adjacent fibers can trigger off bursts of impulses in the trigger zone. The clinical importance of this phenomenon is obvious and, according to Granit and his coworkers,[38] whenever anomalous reactions are encountered this possibility should be borne in mind and an attempt made to localize the critical points or trigger zones. They also believe that a similar interaction can occur between centers within the central nervous system. The question of the blood supply of peripheral nerves has been studied experimentally and clinically by Roberts.[15] He found in animal experiments that sensory and motor changes were closely correlated with the degree of ischemia produced in nerves by various means. These changes resembled the symptoms seen in patients with vasospastic or thromboembolic vascular diseases.

Livingston[40] described a process that plays a very important role in pathological processes such as we are considering. It would be difficult to improve upon his statement of this process:

> An organic lesion at the periphery, involving sensory nerve filaments, may become a source of chronic irritation. Afferent impulses from this "trigger point" eventually create an abnormal state of activity in the internuncial neuron centers of the spinal cord gray matter. The internuncial disturbance in turn is reflected in an abnormal motor response from both the lateral and anterior horn neurons of one or more segments of the cord. The muscle spasm, vasomotor changes, and other effects which this central perturbation of function brings about in the peripheral tissues, may furnish new sources for pain and new reflexes. A vicious circle of activity is created. If the trigger point is removed early, the process may subside spontaneously. If the process is permitted to continue, it spreads to involve new areas, and tends to acquire a momentum that is increasingly difficult to displace. Perhaps in this stage, even a removal of the original irritant may not be sufficient to establish a cure. But if an important part of the circle of reflexes can be interrupted, the process may subside, and a normal physiologic status is again established. If again the pathologic patterns gain the ascendancy, the repeated breaking of the circle may result in a permanent cure.

It is interesting that Riddoch[41] has found that if the pain of a phantom limb has persisted for some time no relief can be obtained by treating the stump or even by doing a spinothalamic tractotomy. The pain seems to be "stamped indelibly on the cerebral cortex." This type of central pain can apparently be relieved by resecting the contralateral sensory area in the postcentral cortex.[42] This point is mentioned because it shows that, if functional vicious circles are not soon broken, they may finally result in organic changes. The phantom limb case was chosen because this expresses the situation vividly.

Trigger points or areas are areas in muscle or skin which on stimulation give rise to pain, muscle spasm, and vascular changes in areas usually at a distance from the trigger area. The reference areas have been found in muscle,[43] the central nervous system,[43] and the skin.[8] The zone of reference need not necessarily be segmentally related to the trigger area; indeed Travell and Bigelow[43] offer very good evidence that the zone of reference may at times be in the nervous system itself. The vasospasm produced there by stimulating the trigger area induces bizarre functional changes. Sinclair[8] believes that a single sensory fiber divides sending one branch to the trigger area and one to the reference zone.

If the trigger point is situated in the zone of reference and if the changes induced by stimulating the trigger point can again stimulate the trigger point, the conditions exist for a vicious circle. Although these vicious circles at times can disastrously derange the functioning of the body, they are merely an example of a more general type of process which it will be

profitable to discuss briefly in order to clarify understanding of them. In engineering, a system in which some of the output of the system is fed back and combined with the original input is called a feed-back system. The ratio of the output of the system to the original input is called the gain of the system. If the gain of the system is less than unity the system is said to have negative or inverse feedback, and obviously the input is greater than the output. If such a system is disturbed, that is, if the input is changed, the output will change less than the input. In other words the system tends to resist change. The normal regulatory mechanisms of the body are examples of negative feedback systems. By deamplifying disturbances applied to the body the physicochemical conditions within the body can be kept constant; this is the necessary condition for efficient functioning. This type of negative feedback is called homeostatic. When the gain of the feed-back system is one or greater than one the system is said to have positive feedback. A system with positive feedback exhibits oscillations which tend to grow and become more violent until the system is destroyed. Livingston's[44] description of the vicious circle is the physiological counterpart of a positive feed-back system. The circle thus represents a perversion of a normal type of mechanism; as McCulloch[45] puts it, ". . . the intrinsic disease of negative feedbacks is that they cease to be negative. . . . As soon as feedbacks operate with a gain greater than one, they cease to subserve their proper ends."

The cure for a vicious circle lies in eliminating the disturbance initiating and maintaining it, reducing the amplification in the system to less than one, or breaking the feed-back loop.

So far we have only considered the discharge of receptors and peripheral nerve trunks under abnormal conditions as the source of impulses which alter the activity of the central neurons of the pathway responsible for the prolonged changes discernible in the osteopathic lesion. However, the flexor reflex pathway in any segment receives impulses descending from the higher levels of the central nervous system as well. Lloyd[46] has shown that the pyramidal tract fibers do not end on the motoneurons directly but on internuncial neurons which are connected with the internuncial neurons of the flexor reflex arc. When the descending volleys are powerful enough to spread to the internuncial neurons of the flexor reflex arc, facilitation of the reflex can be observed. No parallel increase, however, in excitability of the motoneurons themselves can be detected. Obviously, then, the possibility that low motor reflex thresholds may be due to central influences cannot be excluded and should be carefully investigated. Admittedly, why descending impulses should select the reflex arcs of certain segments only to facilitate is difficult to understand at present.

In addition we have to consider the facilitated state of the spinal neurons in the light of processes occurring within the spinal cord itself. Until recently persistence of central activity has usually been explained on the basis of the closed chain type of internuncial circuit demonstrated to occur in the central nervous system by Lorente de Nó.[30] The closed chains make possible prolonged efferent discharge in response to a brief afferent volley. The phenomenon of afterdischarge seen in the flexor reflex is a well-known example of a prolonged, repetitive discharge of motoneurons in response to a single afferent discharge. According to the hypothesis of Lorente de Nó the latter initiates reverberating, re-entrant activity in the closed chains of internuncials which, however, have exit pathways leading to motoneurons. With each circuit of the closed chain a volley reaches the motoneurons. Internuncial neurons are also arranged in a branching type of chain called a multiple chain. The branches of the multiple chains may be parts of closed chains. Gasser[47] has aptly described the functions of these internuncial pools as follows:

> A given stream of afferent impulses over a peripheral nerve follows one pathway in the centers at one time and another pathway at another time. The direction of the switching is conditioned by the situation obtaining at the moment, and is always consonant with a coordinated reaction of the whole organism.

Livingston[44] believes that the switching and coordinating functions of the internuncial pools might be disturbed by impulses from a chronic source of irritation. As we have seen in a discussion of trigger points and areas, it is customary to look on them as sources of an increased afferent bombardment. There is however the possibility that serious disturbances to the normal switching and coordinating functions of the internuncial pools may arise from a *simplification* of the pattern of the afferent volleys due to some peripheral pathological process involving the end organs on the nerve pathways to the spinal cord. Weddell, Sinclair, and Feindel[48] discovered that pain, elicited from an area in which the nerve nets and terminals subserving pain were isolated from their neighbors, had an unpleasant quality and long persistence (10 seconds for a single stimulus) and, which while not very intense, was accompanied by autonomic reactions, "such as appearance of sweat on the upper lip and contralateral palm, dilation of the pupil, and facial contortions." The same phenomena were found to occur in normal skin just before anesthesia occurred as a result of prolonged compression of the arm with a sphygmomanometer cuff. The delay between the pain sensation and the application of the stimulus is much longer than normal due to the fact that the abnormal impulse pattern follows a longer route than usual. Thus we see the possibility that in the lesioned area there may be a compression of a nerve trunk or an interruption of its blood supply which may cause a simplification of the afferent impulse pattern so that different internuncial pathways are traversed leading to abnormal sensory, motor, and autonomic changes. There is some evidence that some such process may actually be occurring in certain states at least. Livingston[44] obtained very good results in treating causalgia due to peripheral nerve injury by forcing the patient to use the causalgic limb normally; in time this leads in a great many cases to eventual restoration of normal function. As he expressed it: "If you wish to have a normal output, you must first establish the conditions which will permit a normal input." Travell and coworkers[49] found that, in treating muscle pain due to trigger areas by injecting procaine into them, it was not the anesthetization of the trigger area that was the essential factor in breaking the vicious circle, but rather the intense discharge of pain impulses caused by the introduction of the needle into the area.

The question arising in our present study is whether or not internuncial activity in the spinal cord can play any significant role in bringing about the enduring state of facilitation demonstrated by Denslow and his associates.[29] In the cerebral cortex internuncial circuits similar to those found in the spinal cord are found, and these have been studied as a possible basis of the rhythmic activity that is characteristic of cortical neurons.[22] The prevailing opinion seems to be that they

cannot explain the rhythmic activity satisfactorily and that other types of interaction may be responsible. In attempting to explain the phenomena of memory and learning on a material basis the possibility of reverberating, self-exciting circuits was at first invoked. Since this type of explanation is difficult to support, recourse is now had to a suggestion of Cajal's to the effect that repeated activity in a certain circuit will lead to growth of synaptic connections existing in that circuit. As a result of this growth the circuit will behave in the same way in the future whenever it is excited in the same way that caused the growth originally.[45,50] It is readily admitted that verifying this hypothesis is next to impossible at the present time, but no other hypothesis seems as promising. Whether a similar phenomenon can occur in the cord also, we cannot say. It is interesting in this connection that, if the pain of a phantom limb has persisted for a sufficient time, as has already been mentioned, nothing short of removing the postcentral gyrus will relieve the pain. Perhaps the "indelible stamping process" on the cortex can be explained on Cajal's hypothesis.

In the last 10 years dissatisfaction with the hypothesis of Lorente de Nó[51] as the sole explanation of persistent central activity has grown, and two alternative hypotheses have been proposed based on recent studies of the electrical activity of the spinal cord. The two hypotheses are not mutually exclusive; in fact, they complement each other and, furthermore, they both assume that re-entrant internuncial circuits play a contributory role. The first hypothesis assumes that the nerve centers in the spinal cord are capable "of a true autorhythmicity, expressing itself, either as an apparently spontaneous activity, or as a repetitive discharge of neurons outlasting the centripetal volleys."[52] The "spontaneous" activity must be set off by slight chemical or nervous stimulation, and hence is not truly spontaneous. However, once the process begins in certain neurons it spreads to other inactive neurons, and the neurons tend to beat synchronously. Both of these processes occur as a result of direct electrical interaction between neurons, the electrical current spreading through the gray matter rather than along the conventional axonal and dendritic pathways.[22,52] Buchthal and Clemmesen[53] found that motoneuron synchronization can be seen as a characteristic feature of voluntary contraction in pathological states such as subacute and chronic poliomyelitis.

The second hypothesis deals with the electrical interaction between neurons through the gray matter and not over the conventional dendritic pathways. Electrotonic potentials arise at the surface of internuncial and motor neurons as a result of incoming activity in one region, and the electrotonic potentials thus set up then spread into inactive regions and there cause changes in excitability. These changes may be excitatory or inhibitory and can affect the ability of the inactive region to respond to incoming volleys.[22,52] It is possible that an interaction such as this between a steady afferent discharge and internuncial neurons leading to the maintenance of autorhythmic discharge in certain internuncial pools may explain the persistent low motor reflex thresholds observed by Denslow. Lloyd[23] appraises the significance of these factors in this respect as follows:

> It seems possible that fields of current or chemical diffusion gradients may only reach critical levels when a number of similarly orientated structures are simultaneously active. With rotation of elements, diffuse activation and "tonic" maintained discharge, the extrasynaptic influences might approach to the steady state in character and thus play no significant role in phasic activity. On the other hand, it is possible that such influences would attain great significance for the long term "state of excitability" of the nervous system.

AUTONOMIC CHANGES

The autonomic changes associated with the osteopathic lesion have been studied by Korr and his associates. He used the skin resistance of the segments as an indicator of autonomic activity. When the resistance to an applied voltage is low in a certain region it means that the sweat glands in that region are active and hence the low resistance indicates activity of the sympathetic neurons that innervate the low resistance area (LRA). LRA often showed dermatomal distribution and could be correlated with low motor reflex thresholds.[54] Korr[55] believes this indicates that the abnormal proprioceptor bombardment facilitates the cells of the intermediolateral columns as well as motoneurons. The LRA's were often hyperesthetic and showed trigger zone characteristics. He also observed LRA coinciding with referred pain zones in cases of duodenal ulcer.[56] Korr's conclusion is that segmental hyperactivity of the sympathetic nervous system is demonstrable as a result of the noxious stimulation.

In the clinical literature there are reported cases of localized vasospasm which are called minor causalgia, traumatic vasospasm or angiospasm, or reflex nervous dystrophy. In this syndrome there is a localized vasoconstriction involving all or part of a single extremity as a result of trauma to that extremity. The mechanism of this phenomenon is reputed to be reflex, the afferent pain impulses from the injured member reflexly arousing an efferent sympathetic discharge to the same limb. On the other hand when a painful stimulus is applied to the skin of normal people it is not possible to obtain localized visceral responses. Sattler[57] showed that a painful stimulus applied to one hand caused as much vascular and skin resistance change in the contralateral hand as was obtained in the hand that was stimulated. This observation has been confirmed by many others and similar vascular changes in response to painful, auditory, and psychic stimuli have been observed in arm, ear, and leg simultaneously. The discussion that followed Sattler's[57] paper is very appropriate:

> Dr. James C. White (Boston, Mass.): Dr. Hinsey, I wonder whether this doesn't fit in with what we know about the general reactions of the autonomic nervous system: that the afferent impulse goes to the cortex, whence it is relayed to the hypothalamus, and then there is a generalized sympathetic discharge. We have been studying the impulses in our patients with Raynaud's disease. After sympathectomy they disappear, both the alterations in skin resistance and the reflex vasoconstriction that normally follows a full breath or sudden noise or painful stimulus.
>
> Dr. Joseph C. Hinsey: I think that may very well be true. However, one would expect there might be some tendency toward localization: that is somewhat greater response on the stimulated side than on the opposite one. But the massiveness of the response that occurs and the fact that it is quite equal, at least in our experience, I think falls in line with our general concept, the concept which Dr. Cannon and others have developed in regards to a response of this kind.

Biologically the function of the sympathetic nervous system is to mobilize the body's defenses in emergency situations, that is, to effect homeostasis; in order to do this efficiently it is organized to function massively as a unit. As is well known most of the preganglionic axons travel up and down the sympathetic chain for several segments giving off collaterals in each ganglion. Secondly the system is closely coupled with a

humoral mechanism, the adrenal medulla, which is activated whenever the sympathetic nervous system is activated to any degree. Finally, that the sympathetic nervous system plays no significant role other than integrating the animal's reactions to environmental changes is seen in Cannon's classical experiments in which he showed that completely sympathectomized animals survive with no apparent disability other than the inability to cope with environmental—both external and internal—stress. On this basis segmental sympathetic activity is difficult to envision.

It is, therefore, profitable to speculate on what the mechanism could possibly be that would explain the observed segmental autonomic activity in pathological states. Sattler[57] supposed that the discrepancy between his experimental results and the clinical evidence lay in the different type of stimulation. It is more logical to suppose in the light of work described in the previous section that the persistent afferent discharge caused by the trauma causes excitability changes in the cells of the intermediolateral column due to the spread of catelectrotonic potentials from the internuncial system of the intermediate grey region, these changes leading to autorhythmic discharge of the preganglionic sympathetic cells or to exaggerated discharges of these cells as a result of impulses from the periphery or higher levels which ordinarily would not produce any effect. This would explain why in the absence of trauma the effects due to noxious stimulation would be confined to the usual channels with no observable segmental effects, while in its presence segmental effects can be obtained. In determining the role of the osteopathic lesion as a factor in the etiology of internal disease, clinical and experimental investigations along this line would offer the approach most likely to be fruitful.

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Lower Extremity Problems In Children

An Osteopathic Approach

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The literature, especially osteopathic, concerning the development of children's lower extremities and the diagnosis and treatment of their disorders is quite limited. Practically the only viewpoint covered is orthopedic in nature. The usual orthopedic approach is to treat the foot and leg as a separate entity, divorced from the rest of the body. This is not the osteopathic approach. The only other place one sees anything written on the subject is in shoe store literature regarding "corrective" shoes. This article is written in the hope that both pediatricians and general practitioners will consider the lower extremities of children from the osteopathic standpoint.

To understand and to treat intelligently the various problems that arise during the development and growth of the lower extremities it is necessary to know the fundamentals of embryological development and the normal changes taking place during childhood. The reader is referred to embryology texts for the complete story of the development of the lower limbs. Only a few pertinent points will be considered here.

The limb buds first appear in the third week of intrauterine life. By the ninth week there is a recognizable foot. At this time the foot lies in the same plane as the leg. In other words, it is in a position of extreme equinus. At first the tibia is longer than the fibula and the talus lies between these two bones. The foot then rotates on its long axis and is brought into supination and adduction. The talus assumes a lower position. The sole of the foot then faces the belly with the legs flexed. Toward the end of the third month dorsiflexion of the foot takes place at the ankle. From then on until birth there occurs a gradual rotation of the entire foot with the exception of the talus, changing from a position of supination toward one of pronation. During this torsional change the transverse and longitudinal arches are formed. The calcaneus moves from a varus position toward a valgus position. The talus gradually changes its position from one alongside the calcaneus until it lies directly on the calcaneus. During this stage of development from adduction and supination to abduction and pronation the inner side of the foot lags behind the outer side in rate of growth. If this development is retarded in uterine life, the growth of the first metatarsal bone may be slowed resulting in the permanent change seen in the adult as the atavistic foot with shortened first metatarsal segment remaining in varus position.

Due to differences in the rate of development both from hereditary and metabolic influences,[1] and from stress factors due to abnormal positioning in intrauterine life and from birth injury,[2] the foot at birth may vary greatly in shape and position, ranging from a very early developmental type with marked equinus, supination, and adduction termed the "club foot," to the abducted pronated type of faulty development. Considering the fact that the human being is a bilateral mechanism, it should be quite logical to assume that stress factors in intrauterine life affecting the cranial and pelvic pattern of growth may cause unilateral differences in development. Under the influence of such a difference an adducted supinated foot on one side and an abducted pronated foot on the other might result.

In addition to the above mentioned factors of development, the inherited metabolic pattern affects through the craniospinal pattern the general type of body structure and function. Two distinct types can be seen in infants, with, of course, many variations between these two extremes.

The first type may be termed the *spastic, contracted,* or *flexion type.* In this type, whether the infant is recumbent or lifted so the trunk and lower limbs hang free, the lumbar and cervical spines show some anterior curving and all joints have a tendency to remain more or less in a position of flexion. The posterior dural stress fibers are short and general fascial tightness is observed. Following the general spinal curve pattern of this type into the cranial base, it will be found that the basilar portion of the occiput will be elevated and the body of the sphenoid and sphenoethmoidal junction will be depressed. If this infant has the early developmental type of foot structure with short first metatarsal segment and adduction or varus positioning of the forefoot, when adult life is reached the foot will be of the cavus type with high arch, shortened plantar fascia, contracted toes, and short Achilles tendons. Tarsal joint motion will be minimal due to contracted short ligamentous structure. If this infant has an exaggerated type of foot development, the foot in adult life will be abducted and pronated but still with minimal tarsal joint motion due to contracted short ligamentous structure.

The second basic type of body structure and function due to inherited metabolic pattern is the *flaccid, relaxed* or *extension type.* In this type, whether the infant is recumbent or lifted so the trunk and lower limbs hang free, all spinal curves remain straight (extended), and upper and lower limbs hang straight and flaccid. All dural stress fibers are weak and general fascial flaccidity is seen. Following the general lack of spinal curve into the cranial base, it will be found that the basilar portion of the occiput and the sphenobasilar junction will be somewhat flattened and the sphenoethmoidal junction somewhat elevated. When weight bearing is established in this type the lumbar and cervical spines will sag forward due to general lack of tone and the over-all pattern of the pronation syndrome[3] will develop. If this infant has the early developmental type of foot structure with short first metatarsal segment and adduction or varus positioning of the forefoot, the adult foot will be in a position of adduction and supination when the forces of gravity are removed, but on weight bearing will pronate and roll in on the short first metatarsal segment. Tarsal joint motion will be excessive due to long, lax ligamentous structure. If the infant has the later developmental type of foot, in adult life it will be a low arched or flat foot, with pronation and abduction (the so-called weak flat foot or splay foot).

Many different combination types of feet are encountered due to blending of the various developmental types and inherited metabolic patterns. By careful examination of the feet and legs of infants

the developmental type as well as the inherited metabolic pattern can be determined. Proper craniospinal and foot treatment instituted immediately can alter the developmental type so the foot and leg can function properly when they become weight bearers and locomotors. The earlier treatment is instituted the more quickly normalization can be accomplished. After the child begins to walk it becomes increasingly difficult to change the developmental pattern. This is why careful examination and management of the newborn is extremely important. With careful observation we should be able to go far beyond the detection of gross changes such as talipes equinovarus or talipes calcaneovalgus. One quick look should establish the diagnosis of such deformities. It is equally important to detect less obvious changes and to institute treatment for them just as rapidly as would be done in the case of gross deformities.

After birth, during waking moments, the baby constantly moves the feet and legs, kicking and twisting them, flexing and extending the toes. This is done to develop and strengthen the muscles, ligaments, and bones to be used in walking. Later the baby attempts to creep, causing further development of feet and legs. After a while it will attempt to pull up in the crib and stand for longer and longer periods. Finally the act of walking will be attempted. During the prewalking stage of development no hampering, restricting clothes and no bed coverings or foot coverings should be used, except as protection against cold. Garments or bed coverings that restrict the activity of the developing foot and leg are harmful. Particularly harmful is the wearing of shoes during this period. The baby will not normally attempt to stand or walk until his muscular and bone development is strong enough to withstand the forces of gravity. No child should be urged to walk, particularly to compete with the children around him. The child is the best judge of when he is ready to take his first steps. When the baby first stands, the feet are placed wide apart to secure as wide a base as possible. At this time body weight is transmitted to the inner side of the foot. The first steps are clumsy and flat-footed. Balance is somewhat unstable because the primitive sensations from the soles of the feet do not permit an even flow of impulses to the cerebral cortex for interpretation. Also the balancing action of the inner arch has not yet been brought into play. Gradually as the sense of equilibrium is established, confidence is gained, and the child brings the feet closer together in standing and walking. Weight is then transmitted to the outer arch allowing the balancing action of the inner arch to take place. The superfluous fat disappears at the arch and remains only in the weight-bearing areas. The whole foot mechanism —bones, ligaments, and muscles—becomes stronger with normal use.

It must be remembered that the act of walking by human beings is not a reflex action. A dominant sensory function is present on the soles of the feet. The baby learns to walk by educating its cerebral cortex in the necessary movements constituting the whole complex process.[4] Once it has learned to walk by the process of educating its cerebral cortex, it remains dependent on the cortex for the initiation of the movements of walking for the rest of its life. This can be shown simply by the experience of trying to walk after one's foot has "gone to sleep" from being in a cramped position. The sense of balance and coordination is lost until nerve function returns.

In man, the upper motor neurons extend from the cerebral cortex to the anterior horn cells of origin of the nerves innervating the muscles of the foot and leg in the lumbar and sacral segments of the cord, located in the lower dorsal and upper lumbar portion of the spinal canal. The lower motor neurons must then extend from that point to the foot and leg. These upper and lower motor neurons are the longest in the body. Any pathology from the cranium to the foot can affect the function of the foot. This is why we should approach foot problems from the osteopathic rather than from the orthopedic standpoint.

In considering the act of walking, the subject of shoes must be considered. From birth until walking begins, the only foot covering should be loose and nonhampering, and used only to protect the foot from cold. When weight bearing begins the foot has to meet an entirely new condition, that of contact with a surface. Even under this new condition it would be most desirable if no shoes were worn, permitting normal growth and progress unrestricted by the hampering influence of shoes. If the child's activities could be carried out on soft turf or in sand, or on any other resilient surface, ideal growth of foot and leg would be possible. Unfortunately, in modern civilization this does not occur. Most of the modern child's weight bearing is done on hard, nonresilient surfaces which, instead of providing a suitable medium for development, put an additional jar stress on the foot. Some form of protection is therefore necessary to prevent this jar. This fact and the element of custom decree that the child wear shoes.

Because the modern child's feet are encased in shoes which restrict motion and hamper development, they will never be as strong and versatile in function as the feet of barefoot races. At the present time the accepted procedure is to place the child in high shoes, first with a spring heel and later in the so-called "orthopedic shoe" with extended counter and Thomas heel, wedged at the inner side to "support the ankles" and "prevent pronation and knock-knees." Logic tells us that placing a circular restriction about the lower leg will interfere with normal circulation and muscle and tendinous action in the foot. Thus the "support" furnished by this type of shoe actually prevents normal development and weakens the foot mechanism.

Only two things are essential in considering the foot coverings for a modern child. First, it is necessary to place something resilient under the sole of the foot as protection from hard surfaces. Second, it is necessary to furnish protection against the elements. To provide these two essentials and to eliminate as far as possible restriction to the normal action of the foot, a sandal with a flexible, flat leather sole and open strapping type of upper for summer months and a soft leather upper of the oxford type for winter months would be ideal. I believe the trend in shoe manufacture will gradually turn to this type of shoe for the child. Actually the better grade of oxford-type sneaker makes a good foot covering for the child during the summer months. I realize this line of reasoning is a radical departure from the usual orthopedic thought but logical consideration should prove its correctness. We must remember that the foot continues to develop and grow after birth until adulthood. Any shoe interferes with normal development.

The words "support," "bracing," or "shoe corrections" should have no place in the management of lower extremity problems in children. When we use

these things we are admitting failure in osteopathic management. Support weakens any structure and the function of that structure, so that eventually the support becomes a necessary crutch. I do not believe we should subject the child to that type of therapy. He will not thank us for it in later life. If we can break away from the orthopedic approach of "supporting" weak structures and reason logically that the various types of foot structure and imbalance in the child are due to hereditary metabolic and craniospinal patterns during development, the manner of approach and treatment of these conditions become clear. This approach is osteopathic in its scope and includes careful minute examination of the newborn's cranial and spinal pattern in addition to the examination of the lower extremities, followed by early osteopathic manipulative treatment to correct abnormalities before weight bearing is started.

To forestall misunderstanding and controversy, let me make it clear that I do not wish to imply that proper orthopedic management does not have its place in the management of all cases of bone pathology. Great advances have been made in the orthopedic management of bone tuberculosis, other bone infections, osteochondropathies, and malignancies. These problems belong properly in the orthopedic field. However, cases of altered structural development without actual bone disease belong properly in the field of osteopathic manipulative management.

In examining the lower extremities of infants the tone of all musculature should be checked, and the two extremities compared. Particularly flexion contraction or excessive flaccidity should be watched for. Any inequality in these factors deserves special consideration. The position of the feet when they are suspended in air should be checked, with special attention to equinus or calcaneus positioning of the foot on the ankle. Also supination and adduction or pronation and abduction of the foot should be looked for, with careful checking for variation in position of the two feet. Then range of motion of both feet as to supination and pronation, adduction and abduction, and dorsiflexion and plantarflexion of the foot on the ankle should be tested. The knees should next be examined. Unequal or excessive valgus or varus positioning should be watched for. The hip joints should be checked carefully for range of motion. Greater trochanters must be palpated for their relative positions in relation to the iliac crests and the pelvis examined for any distortions or twists. Torsion of the pelvis will always be found when any asymmetry or inequality exists in the lower extremities. The asymmetries or inequalities in the lower extremities and pelvis will indicate the pattern that will be found in the cranial base. The occiput will be found in the same position as the sacrum. The atlas will be found in the same position as the fifth lumbar vertebra.

When even slight asymmetry in either positioning, motion, or muscle tone is found in the lower extremities, immediate treatment is indicated. Also, any change from the normal metabolic pattern requires immediate consideration. It is impossible in the scope of this paper to describe the various osteopathic manipulative procedures used. The reader is referred to the proper sources for this material.

The method of examination and plan of treatment of lower extremity problems in children who have reached the walking stage follows the same general pattern as that for infants. The difference will be that treatment will be necessary over a longer period.

SUMMARY

The development of the lower extremity before and after birth has been discussed from the osteopathic viewpoint. This should be the proper approach in the diagnosis and management of lower extremity problems in children.

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THE NEXT HALF CENTURY IN BIOCHEMISTRY

The future is the continuation of the past, the present being the dividing line between the two. If we want to see ahead we must look back. Biochemistry has developed during the first half of this century into a very queer science. It has had the most astounding successes. With the isolation of vitamins it has eradicated mysterious diseases which yearly claimed thousands and millions of lives. It has increased our general resistance to disease, spread health and happiness. With the isolation of hormones it took in hand the tools with which nature regulates our functions and development. We can almost raise the dead, transform male into female and even change psychic characters. The biochemist is nothing short of a miracle man. But if you ask him to explain these reactions he provokes he will have to confess his utter ignorance. I dare say there is not a single hormonal function which is understood. The biochemist is like the savage who can produce fine music by throwing a coin into a music box, but has no idea about the mechanism. We know a great deal about the molecules of hormones and vitamins, so our ignorance must be due to our not knowing the other partner in the bargain, the living matter. So I can tell you in one single sentence what I expect from biochemistry as its main contribution during the second half of this century. The first half we have spent in isolating active substances. The second half will be spent in explaining how they act—by *penetrating into the structure and organization of living matter,* giving herewith to medicine the foundation it needs to be elevated into the status of a science. —Professor Albert Szent-Györgyi, in The Next Half Century in Medicine. Sterling-Winthrop Research Institute, 1950.

Progressive Muscular Dystrophy

Report of a Case

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Although progressive muscular dystrophy is a rather common muscular disturbance, this case is reported because it presented the typical history and findings and because there were available a number of photographs to illustrate the progression of the disease. Such pictures are not usual in the literature and are so graphic as to warrant their publication.

A 10-year old white male was seen with a chief complaint of inability to walk. The past history was quite vague because it was obtained from his father and stepmother. His mother died of pneumonia several years ago, after living a number of years with rheumatic heart disease.

This child was apparently normal for the first 3½ years of his life. He started to walk at 8 months and evidenced no difficulty. At about 3½ years of age he began to slap his forefeet when he ran; this later developed into toe walking. A little later he had difficulty in getting up off the floor and the father would notice him sticking out his chest when he ran as though he were trying to maintain his balance. When 4 years old, he began to waddle like a duck when he walked or ran. At about the age of 5 he started to lose weight. The loss was especially noticeable because of the winged scapulae which were developing. The father thought of the possibility of worms and administered proprietary worm medicine.

After the child started to school at the age of 6, he would suddenly become relaxed while walking and fall down as though he was an inanimate object. Then he would arise by climbing up on himself. At the age of 6 his face began to be expressionless. At 8 years of age he could no longer stand erect and had to crawl or creep.

His appetite and digestion have been good and elimination normal. He has not had any operations and has never had a cold. He had measles at 5 years, pertussis at 10 years. He enjoys playing with his siblings, his stepsister, and his half-brother, all of whom are well and normal.

Physical examination revealed a rather emaciated child with marked pallor. Because of his inability to extend his legs and the weakness of the erector spinae muscles, he was unable to stand. He sat in a slumped erect position using his arms in full extension for support. Examination of his head, chest, and abdomen showed nothing abnormal except for the loss of muscle tone and muscle atrophy. His extremities were very thin and practically useless. There were contractions of the Achilles tendon and the flexors of the knee. The deep reflexes were lost, but the superficial reflexes appeared normal.

Urinalysis and complete blood count were normal, except for a decreased amount of creatinine in the urine. Blood chemistry was not done because of inability to obtain sufficient blood.

The diagnosis is, of course, progressive muscular dystrophy or idiopathic muscular atrophy. The disease is apparently of the Leyden-Moebius type, according to the classification of Lewin,[1] because of the absence of pseudohypertrophy. However, Shank[2] does not choose to differentiate between this form and the pseudohypertrophic type. He claims that parents often overlook the pseudohypertrophy or it may be transitory.

Diagnostic features not found in this history may be mentioned. There may be delayed walking, awkward gait, and inability to negotiate stairs. The children appear clumsy and frequently complain of being tired. Fibrillary twitchings and disturbances are absent and it might be said that there are no symptoms of involvement of the nervous system.

Several conditions must be considered in the differential diagnosis of the muscular dystrophies. Amyotonia congenita gives a history of lack of muscle tone and development since birth. Myotonia congenita is usually noticed in early childhood, although it may

Fig. 1. Patient at 16 or 18 months of age. His appearance is normal. Fig. 2. In this picture at 4 years of age, beginning size change in the gastrocnemius is apparent. Fig. 3. At 5 years of age, abdominal protrusion is becoming evident. Fig. 4. The characteristic high-stepping gait is plainly seen in this picture taken at the age of 5.

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5. In this picture taken at the age of 6, the typical expressionless face is plainly depicted.

Fig. 6. At 7 the patient is shown in the arched sitting position.

not be manifested until puberty. It is a condition in which the muscles, if stimulated by external stimuli, will go into a state of contraction and remain so for 10 to 30 seconds. When these individuals grasp an object they find it difficult to release the grip for several seconds and when they get up from sitting and start to walk a hesitancy is noticed for a few steps. Myasthenia gravis is characterized by weakness of the muscles of mastication, speech, and swallowing, and later involves the muscles of the neck, trunk, and extremities. It is not an entity of childhood although it may occur. Familial periodic paralysis is a disease of childhood and is manifested in a flaccid paralysis of the extremities. Attacks usually occur at night or after periods of inactivity. Low concentrations of potassium salts in the serum appears to be the causative factor. Poliomyelitis is differentiated by the history and the sudden onset. Progressive spinal muscular atrophy usually gives cord symptoms such as spasticity and atrophic paralysis, plus muscular fibrillary twitchings. Progressive neural muscular atrophy develops in early childhood. The muscles first affected are the peroneal and the extensors of the toes, causing the child to walk on the outside of his foot and producing drop-foot and clubfoot. Fibrillary twitchings are common.

Treatment in progressive muscular dystrophy is limited. Different authorities offer various suggestions, but no definitive therapy has yet been presented. In this case, the treatment has been chiefly osteopathic manipulative and dietary. The suggested diet was one high in protein and low in fats and carbohydrates. Osteopathic manipulative treatments were given once or twice a week and were general in nature with specific attention to the upper dorsal, lumbar, and sacral areas. Manual traction was applied to both the legs and feet in attempt to reduce the amount of contraction. The child has been under this regime for 18 months and he appears to be slowly getting more helpless.

1515 State St.

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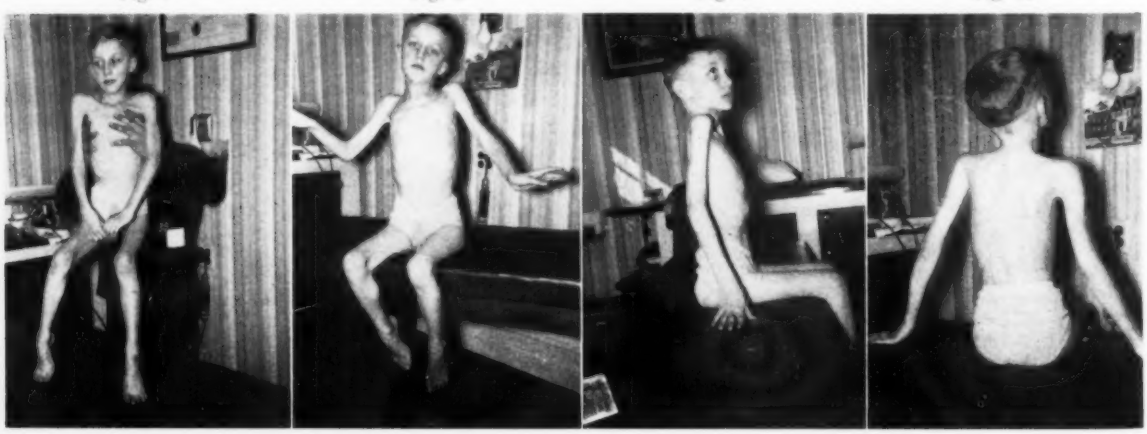
DISCUSSION

F. Munro Purse, D.O., Philadelphia. Children over 6 years of age should be subjected to a general neurological examination as is given to adults, but infants tax the ingenuity

Fig. 7. At the age of 10, the contracted Achilles tendon, wasp waist, and loose shoulders are apparent. Fig. 8. Results of attempts to raise his arms. Fig. 9. Sitting position. Fig. 10. Winged scapula are prominent.

Fig. 7 Fig. 8 Fig. 9 Fig. 10



of the most patient examiner. Ingenuity is also required to obtain a thorough history, for the physician must evaluate the reliability of those giving that history. Extreme thoroughness and ingenuity were shown in this case, and the time-consuming task resulted in an accurate diagnosis.

It is well known that progressive muscular dystrophy in man is a familial disease, affecting males more frequently than females. In some families it appears to be sex-linked, being transmitted through the apparently healthy mother. At first thought, these facts might seem to negate a possible nutritional causation. However, there is apparently a disturbance in the muscle metabolism and possibly some disturbance of the neuromuscular juncture. The nervous system itself is not involved in the disorder.

Several clinical varieties of progressive muscular dystrophy have been recognized, based on the age of onset and the location of affected muscles. However, there are no essential pathological differences in the various types.

Pappenheimer and Goettsch[1] point out that this type of dystrophy can be experimentally produced in rabbits by giving the mother rabbit an amount of vitamin E just adequate to protect her through life from developing this muscle disease, but insufficient to enable her to give birth to living healthy young. Although it is difficult at this time to estimate the importance of the tocopherols in human nutrition, and still more hazardous to define the precise role which these substances or lack of them assume in human pathology, there are nevertheless certain very suggestive analogies between the laboratory disease and certain human disorders.

Should detailed dietary studies fail to disclose an inadequate intake of vitamin E in the mother, there would still have to be considered the possibility of deficient absorption or utilization of vitamin E, or of certain factors bringing about its destruction in the intestinal tract or within the tissues. Such faulty mechanism of absorption or utilization may turn out to be a genetic metabolic trait.

The published evidence indicating a favorable effect of vitamin E treatment upon the course of the human disease is as yet very scant and even authorities such as Vogt-Moller[2] do not venture to draw conclusions. However, it is interesting to note that in recent months there has been produced a vitamin E preparation* which is reported to produce "blood levels many times higher than can be achieved with solutions of these vitamins in oil." What effect, if any, this will have upon the therapy of progressive muscular dystrophy remains to be established.

*Esorb, a product of Wyeth Incorporated.

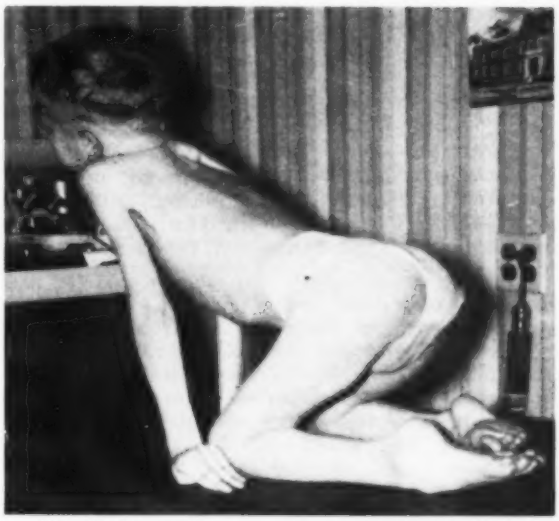


Fig. 11. Here, at the age of 10, the patient is attempting to get up, but can not; he is even unable to hold this position for more than a very short time.

As the name implies, the disease is progressive with some periods more rapid than others, but with death usually occurring within 5 to 10 years of the onset. The child whose case is reported here is still alive more than 6 years after the first signs appeared. Intercurrent infection is the most common cause of death.

Our experience, like that of many others, has been too limited to draw any conclusions concerning the value of osteopathic manipulative therapy. It would seem, however, that if this disorder is due to a disturbance of metabolism of vitamin E, whether it be deficient absorption or utilization, any attempt at normalization of the body should be of value.

1818 Pine St.

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ANATOMY

We often wonder how many students grasp the real meaning of anatomy. It is quite possible that to many of them anatomical study means simply a memory recitation of more or less assembled parts with very little definite idea of the plan and purpose antedating structural formation and functional requirements. . . .

It is clear that too frequently the studies of anatomy and physiology are divorced from their central and mutual concept. Many of the ideas and theories are mere projections on separate planes without any thought of correlation. And the results cannot be otherwise than a certain chaos in so far as totality of purpose and reciprocating influences are concerned. . . .

The success of osteopathy . . . has been and is absolutely dependent upon a knowledge of structural anatomy, living anatomy as revealed to the tactual sense.

This knowledge cannot best be learned from text-books and cadavers alone. Supplementary knowledge as expressed by the living tissue, especially if detail facts are constantly comported with basic and unifying principles, with a constant checking of the tactual sense, will quickly teach the student the value of the osteopathic elements. Hereby is where osteopathy actually becomes a living principle. . . . Anatomy will not mean one thing, physiology something else, and pathology still another study; but all will be revealed as part and parcel of a complete organism constructed and functioning after a definite plan.—Editorial reprinted from THE JOURNAL OF THE AMERICAN OSTEOPATHIC ASSOCIATION, June, 1921.

An Introduction to the Clinical Aspects of Gastroscopy*

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Seventeen years have elapsed since the flexible gastroscope devised by Schindler was introduced. Free from most of the dangers inherent in the previously used rigid tubes, this instrument has made possible direct inspection of most of the gastric surface.

The increasing efforts and ingenuity on the part of manufacturers and their utilization of suggestions for improvement of the instrument from those interested in the gastroscopic field have led to progressively more refined and perfected instruments. In the not too distant future, perhaps, the ideal instrument incorporating a feature which will allow for practical photography, aspiration, and biopsy will become a realization.

The purpose of this paper is to answer and to discuss the question, "Does gastroscopy have practical and clinical value?" The answer to this question must be a definite affirmative.

The constant accumulation of data has proved gastroscopy an *important* and *decisive* source of diagnostic information supplemental to roentgenologic studies and a unique source of direct information. The numerous confirmations of gastroscopic diagnosis by histologic study can leave no doubt as to the accuracy of gastroscopic observation.

In general gastroscopic survey has not been utilized as extensively as it merits for two reasons: first, because of lack of awareness of its merits, and second, those acquainted with the procedure are prejudiced against it because of so-called blind spots, contraindications, discomfort, and dangers of the examination. That the procedure has limitations does not prove it useless, but merely places it in the same category with other diagnostic measures. The blind spots are reduced to a minimum with the use of the most recent innovation in gastroscopes and gastroscopy, the flexible tip controlled at the eyepiece. There are contraindications, as with other procedures requiring instrumentation. Among them are debility, respiratory diseases, severe cardiac conditions, psychosis, esophageal obstruction, achalasia, and severe scoliosis. The dangers and discomforts are minimal in the hands of a capable gastroscopist who observes contraindications, follows a routine, is alert to the latest methods of preparation, and is adept in the art and technic of gastroscopic intubation.

While the contributions of gastroscopy to clinical medicine have been numerous, perhaps the greatest has been the classification and description of mucosal appearance which permits the accurate diagnosis of gastritis. No other means or measure can provide the definite information necessary to this diagnosis.

Gastroscopically the gastritides have been classified as hypertrophic, superficial, and atrophic. Their diverse symptomatology, the variable results from comparative studies of gastric analyses, and inconclusive roentgenologic findings, have established gastroscopy as the only means for making an accurate clinical diagnosis.

Chronic hypertrophic gastritis is one of the most common gastric diseases and may be found in any part of the stomach. It may be confluent over an irregular area involving a large part of the mucosa or it may have a patchy type of distribution. The distal half of the pars media and areas at either end of the angulus and just above the greater curvature on the posterior wall are the sites most frequently involved.

When viewed through the gastroscope certain characteristics of the inflammatory process are apparent. There is a loss of the normal translucent appearance of the mucosa; it appears dull and lifeless. Edema may be present and the characteristic change in the rugal pattern is observed. The rugae may appear giantlike and hyperemic or the mucosa may present a cobblestone appearance. Erosions are frequently present as well as excessive mucus.

As with the other forms of gastritis, there is the tendency for the patient with hypertrophic gastritis to complain of ulcer-type epigastric distress and night pain which, although relieved by food or alkali, has a tendency to persist. Hemorrhage is most common in the hypertrophic form of gastritis.

Chronic superficial gastritis is also quite common. It is the type most responsive to therapy and in most instances leaves no gastroscopically observable sequelae. Some cases, in spite of therapy, progress into atrophic gastritis and the two diseases may be observed concurrently in the same stomach. It is well to keep the superficial-atrophic mucosal disease entity in our clinical thinking.

The patient with the superficial form of gastritis is usually in the age group between 30 to 40. Epigastric pain without radiation tending to occur after meals may be significant. Other complaints may be nausea, anorexia, weight loss, weakness, and diarrhea. Gross bleeding may occur.

The gastroscopic findings establishing the presence of this disease are patchy hyperemia and the presence of a gray, opaque, thin exudate, fluid yet tenacious, with a tendency to lie in the rugal gutters. Erosions, petechiae, and bleeding are often seen.

It is obvious to the internist that the gastroscopic finding of a hyperemic, hypersecreting gastric mucosa cannot substitute for sound clinical judgment and patient evaluation. The diagnosis of superficial gastritis should not be made glibly in an attempt to explain symptoms. When a grossly red, erythemic mucosa is encountered, diverse etiologic possibilities should be considered; for example, psychogenic, allergic, and postinfectional conditions; duodenal or cholecystic abnormalities; or chemical or mechanical irritants.

I believe it wise to think of chronic atrophic gastritis as stemming from two separate entities: (1) the idiopathic atrophic gastritis, mentioned in connection with the superficial form of gastritis, which results from an apparently isolated inflammatory process and (2) the atrophic gastritis associated with some of the deficiency processes, as pernicious anemia, avitaminoses, hypothyroidism, or occurring in the patient who is generally debilitated.

The patient with the idiopathic form is usually in the older age group. Epigastric distress described

*Presented at the annual meeting of the American College of Osteopathic Internists, Philadelphia, October 15, 1949.

as pain pressure or fullness and nausea, and vomiting may be present. Weakness, fatigue, anorexia, paresthesias are other complaints which are sometimes present. The patient may appear depressed and cachectic. The various facets of the problem could cause it to be confused with a deficiency state, psychoneurotic condition, or a malignant process.

The gastroscopic appearance of this form of gastritis is in the main due to the loss of the gastric chief cells, which are apparently responsible for the opacity of the mucosa. When the mucosa is seen, the most impressive factor is the abnormal color which varies from gray to gray-red and gray-green. The highlights are normal or increased and diffuse, rather than spotty. The blue venous channels of the submucosa are readily apparent and are an important part of the endoscopic picture. An arborization of converging veins is also seen in every field. The rugal pattern is not necessarily altered, but there may be a tendency for the rugae when present to efface more readily and to reform more slowly as air leaves the stomach than is normal.

Any degree of mucosal involvement may be present, ranging from isolated, patchy distribution to confluent areas and generalized distribution. The antrum and fundus are most frequently spared, with a predilection for the anterior and posterior walls of the pars media.

I base my appraisal of the degree of severity on the prominence of the submucosal veins, the extent of involvement, and the appearance of the mucosa generally. Each endoscopist must formulate his own criteria of severity.

A most practical consideration is the gastroscopist's responsibility to the patient with an atrophic mucosa for the detection of early tumor formation, since the atrophic mucosa predisposes to true adenomatous polyp formation and to inflammatory pseudopolyp formation, both precancerous lesions. This matter will be touched on again in association with the discussion of atrophic gastritis and pernicious anemia.

The demonstration of gastritis is valuable in determining the etiology of many cases of previously unexplained hematemesis. The worth of this particular contribution must be stressed because of the frequent absence of demonstrable x-ray abnormalities in some major bleeding episodes. There still remain cases of hematemesis of elusive etiology, but the number is constantly being reduced by integrated radiologic, gastroscopic, and esophagoscopic studies. I mention esophagoscopy because of that group of moderately sized paraesophageal hernias in which the esophagoscope may demonstrate a congested, bleeding area in the herniated portion of the stomach, while the remainder of the stomach appears normal to routine gastroscopic survey. From the foregoing one becomes aware of the clinical value of gastroscopy in the presence of unexplained upper segment hemorrhage.

In unexplained persistent achlorhydria, refractory hypochromic anemia, and in pernicious anemia much may be contributed by the gastroscopic survey of the gastric mucosa. The findings may suggest further efforts in management and therapy.

We are all aware of the implications of persistent achlorhydria, chronic mucosal inflammation, atrophic gastritis, gastric atrophy, neoplasia, or anemia. Atrophic gastritis, either as idiopathic gastritis or occurring in association with a deficiency state, may well be the etiological factor in a resistant hypochromic anemia.

Gastroscopic examination of every patient with pernicious anemia is clinically important because the atrophic gastric mucosa is fertile soil for the development of adenomatous and inflammatory polypi. There is a tendency for polypi, especially those associated with the atrophic form of gastritis that may accompany pernicious anemia, to undergo malignant degeneration. And because of the insidious onset of the neoplastic aspect, gastroscopic survey every 3 to 6 months is advisable for the protection of the patient and is good preventive medicine.

Gastroscopy is important diagnostically in gastric carcinoma. Some areas of the stomach are more prone to malignant invasion than others, the incidence being as follows: pylorus, 50 per cent; lesser curvature, 20 per cent; cardia, 9 per cent; greater curvature, 7 per cent; anterior and posterior walls, 14 per cent. The competent gastroscopist visualizes the pylorus in excess of 90 per cent of cases, thus permitting direct appraisal of the pyloric area, the most common site for neoplastic growth. While no gastroscopist will state that he can always differentiate between benign and malignant lesions, the percentage of accurate differentiation is high and a precise anatomical diagnosis in gastric neoplasia can be given in most instances.

When appraising a lesion gastroscopically, I give attention to the following points: Shape, surface, structure, surrounding area, margins, color, whether or not the posterior wall is displaced or indented by the aortic impulse, tolerance of stomach to insufflated air, collapse after eructation, mobility of the field, and the size of the lumen of the stomach.

If a malignant lesion is present, an attempt is made to classify the lesion as to type. The Borrman classification as interpreted by Schindler is used by gastroscopists. Types and their incidence are as follows: Type I, the sharply limited polypoid lesion (3 per cent); type II, the ulcerative carcinoma entirely surrounded by an elevated wall (17 per cent); type III, similar to type II having a partial demarcation, but at some point blending with bordering mucosa which is diffusely infiltrated; type IV, the diffusely infiltrating type of neoplasm. Sixty-nine per cent of cases fall into this last classification.

I will at this point mention the leiomyosarcomas and the lymphomas that may be diagnosed gastroscopically. Gastric visualization also aids in selecting the proper therapeutic measures and may be of extreme value to the surgeon in determining the extent and resectability of a malignant lesion. Incidentally, I think it good judgment on the part of the surgeon to submit vagotomy candidates for gastroscopic appraisal.

In the presence of a suspicious gastric lesion, an important factor is whether or not the roentgenologist and gastroscopist agree concerning the benign or malignant nature of the lesion. The patient should be vigilantly followed by both. There should be no controversy as to the accuracy or infallibility of one procedure or the other; neither method is entirely accurate or infallible. All known facts should be correlated before a final opinion is given.

I believe it in order at this time to mention the prophylactic aspect of gastroscopy, with special reference to the patient in the fourth decade presenting upper gastrointestinal complaints in the presence of normal x-ray findings. This is an approach to pre-

ventive medicine as yet receiving little support. Gastric ulcer occurs much more frequently than it is diagnosed. In acute, subacute, or chronic cases the niche may be too shallow to permit x-ray demonstration. I have frequently observed small shallow ulcers on the anterior wall side of the lesser curvature, on the lesser curvature just proximal to the angulus, and on the posterior wall. In such instances, as well as in others, endoscopic survey frequently supplies the answer as to the cause of persistent gastric distress. Gastroscopy should most definitely be utilized when diagnostic findings are not compatible with the history or complaints pertaining to the digestive tract.

Gastroscopy is valuable in managing the psychogenic disturbances of the upper digestive tract. In the cancerophobic patient, gastroscopic examination with an explanation of the normal findings has potent therapeutic value. This method, in association with psychotherapy, is applicable in gastritis of psychogenic origin. I have seen gratifying results time and time again.

I was duly impressed during the war years with the gastroscopic appearance of the mucosal reaction to psychogenic stimuli. I frequently saw such reactions in the female patient with upper digestive symptomatology who had reason to be concerned over someone in the armed forces. The mucosal pattern observed was that of hyperemia associated with numerous isolated areas of marked petechiae, which were prominent. Hyperperistalsis, hypersecretion, and, usually, associated pylorospasm of a marked degree were also observed. The anterior wall seemed involved more frequently than any other area. I have also been impressed with the comparative infrequency with which I have seen this type of mucosa of late except in the patient in whom a psychosomatic mechanism is discernible. It is wise to remember that the abdomen is the sounding board of the emotions.

Advancement in clinical and physiological knowledge of the stomach lies in more frequent use of gastroscopy by the internist. More information concerning functional disturbances and deficiency states involving the gastric mucosa and advances which will enable further differentiation of benign from malignant processes may be expected from the intelligent use of gastroscopy.

With continued accumulation of data we will come to know the value and effects of therapy in specific instances and, perhaps on the basis of the general appearance of the mucosa, a prognosis may be given. Added information concerning normal and abnormal gastric motor behavior and mucosal reactions will better our understanding of symptomatology in allergic states, systemic diseases, specific infections, postoperative states for example, vagotomy, and postinfective states. Gastric mucosal reaction to hepatic, cholecystic, and duodenal function and diseased processes will become better understood.

SUMMARY

An introduction to the clinical aspects of gastroscopy has been presented.

1. The importance of the contributions of gastroscopy to clinical medicine was emphasized.

2. The diagnosis and classification of the gastritides was discussed.

3. The use of gastroscopy in upper segment hemorrhage, achlorhydria and in refractory and pernicious anemias was mentioned.

4. The atrophic mucosa, polypi formation, and pernicious anemia were discussed, with special reference to the prophylactic aspect of gastroscopy.

5. The gastroscopists' contribution to the diagnosis and classification of carcinoma was delineated.

6. Information derived from gastroscopic examination of patients with psychosomatic disturbances was touched upon as were its therapeutic implications.

7. Some clinical and physiological research problems, in which gastroscopy, if utilized more frequently, could perhaps contribute much of practical value, were mentioned.

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THE CAUSES OF OVERWEIGHT

The most common causes of overweight are too much food and too little exercise. Any unusual accumulation of fat caused by lessened activity, such as sometimes occurs at puberty and the menopause and during pregnancy or convalescence from an illness or operation, may be the beginning of overweight, since it frequently tends to become permanent. Orthopedic defects, such as fallen arches, poor posture, and bone disease, which also lessen activity, may contribute to overweight. In some few persons it is caused by disease of the glands of internal secretion. Although in some individuals overweight seems to be hereditary, this is probably due to a hereditary type of body build, aided by environment. While bony structure cannot be influenced greatly, overweight usually can be prevented from becoming a dangerous factor in such cases, though it may be more difficult to accomplish lasting results.—Overweight and Underweight. Metropolitan Life Insurance Co.

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THE PROBLEM OF CANCER

Although the problem of cancer is age-old, it has become in recent years more pressing and the need for a solution more urgent. Consequently there has been in the last decade a tremendous increase in public interest and growing demands that the disease be brought under control. Within the last half century cancer has moved from eighth to second place as a leading cause of death, and as the number of deaths from this cause has grown, the economic and social problems connected with it have multiplied.

The impact of the cancer problem on the population is in part due to its extent—at present in the United States approximately 200,000 deaths a year, or about 14 per cent of deaths from all causes, are due to cancer. Reduced to more tangible terms, this means that in 1 year in the average American community of 10,000, there will be about 100 deaths, 14 of which will be due to cancer. Few diseases disrupt family life in the manner that cancer does. It frequently develops at the height of the individual's productive period, when his responsibilities are at their peak. It is a disease which creates a drain on family finances and a strain on family living because of its prolonged course.[1]

Today the medical miracle is commonplace, and advances in the control of cancer are to be expected. There seems to be progress toward a simple test which will instantly and accurately reveal the presence of cancer in the body; research workers could be on the brink of a medicinal cure; prophylaxis does not seem an impossibility.[2] Indeed today much is known concerning cancers initiated by exposure to environmental and exogenous conditions and steps are already being taken to avoid them. Much more can be done on the basis of existing knowledge to prevent cancers due to various industrial and occupational hazards.

But the greatest immediate hope in the control of cancer lies in the application of known methods of therapy, and the chances of success of those methods hinge almost without exception on a single factor—early diagnosis. Procrastination in cancer is tantamount to a death sentence.

The question then arises as to how early diagnosis is to be assured. The answer lies in education—education of the public and education of physicians.

Public education as to the nature and significance of cancer is a prerequisite to control. A cancer educational program should remove the misconception that the disease is incurable and is associated with prolonged pain and suffering. The publication of factual data about cancer and the development of a reasonable attitude toward it are necessary steps in control. It will accomplish little to establish in the individual a fear so intense that he will not look for signs of cancer and will not act even if he becomes aware of symptoms. It is possible to design a program that will lead to a commonsense attitude which will cause the individual to be healthily alert to the signs of the disease and, if evidence presents itself, to seek attention at once.[1] The education of the public must of necessity be undertaken by public health and volunteer agencies.

However, since cancer is frequently symptomless in its initial and most curable stage, early diagnosis is often made in the physician's office in the course of examination for other conditions. Thus the nature and obscurity of the disease frequently places the responsibility for the initial diagnosis in the hands of the general practitioner and, as Hoskins[3] points out, no physician can make a diagnosis of any disease unless the possibility of its existence occurs to him. Hoskins goes on to say that through routine examinations made with the manifestations of cancer in mind, a higher percentage of lesions may be diagnosed in the precancerous or very early stages than by any other presently known method.

To the end that osteopathic physicians may be alert to the signs and symptoms of cancer, Hoskins suggests that osteopathic colleges might present the subject of oncology in a more concentrated course. At present the student is left to acquire a general idea of the subject in pathology and more specific ideas in dermatology, urology, gynecology, surgery, et cetera.

Recognition of the need for improvement of undergraduate education in cancer is not limited to osteopathic schools, as evidenced by a report from the National Advisory Cancer Council, "Cancer in the Medical School Curriculum,"[4] an adaptation of which was published in THE JOURNAL. This report frankly admitted the inadequacy of present teaching methods and, while it offered no panacea, it suggested practical approaches to the betterment of instruction.

1. Kaiser, R. F.: Why cancer "control"? Public Health Reports 65:1203-1208, Sept. 22, 1950.

2. Overholt, R. H., and Atwell, S. W.: Cancer of the lungs. American Cancer Society, 1950.

3. Hoskins, D. A.: The early diagnosis of cancer. J. Am. Osteop. A. 49:556-559, July 1950.

4. Cancer in the medical school curriculum. J. Am. Osteop. A. 48:409-411, April 1949.

The rate at which schools of the healing arts improve the training in cancer diagnosis and treatment, at which practicing physicians are stimulated to self-education and patient observation, and at which the public is taught the necessity for intelligent and non-emotional self-observation and regular physical examination will undoubtedly be paralleled by a decline in the number of deaths from cancer. Surely a decrease in mortality from this devastating disease is worth the price of education and of vigilance.

NEW PRESIDENT AND DEAN FOR PHILADELPHIA COLLEGE

Mr. Frederic H. Barth, president of the joint boards of the Philadelphia College of Osteopathy and the Osteopathic Hospital of Philadelphia, recently announced the appointment of Kenneth L. Heaton, Ph.D., as president, and Frederick A. Long, D.O., as acting dean, of the College.

Dr. Heaton was formerly dean of administration of Boston University. During World War II he served as chief of Program Development and Research, Civilian Personnel and Training Division, Office of the Secretary of War. He has been research consultant to the Secretary of Defense since 1948. He is the author of several books on problems of education. Dr. Heaton received his A.B. from the University of Indiana and his Ph.D. from the University of Chicago.

Dr. Long graduated from the Philadelphia College of Osteopathy in 1942 and has been with the college in a teaching capacity since 1925. Since 1945 he has been professor of neurology and psychiatry at the College and chairman of the Department of Psychiatry and chief attendant in neuropsychiatry at the Hospital. He will continue in these capacities in addition to serving as acting dean.

Both Dr. Heaton and Dr. Long assumed their new duties October 1.

OSTEOPATHIC CHRISTMAS SEALS

In 1931, the Board of Trustees of the American Osteopathic Association, recognizing the need of loans to worthy students of osteopathy, established the Committee on Student Loan Fund and authorized the sale of Christmas seals to establish the fund. The first seals were sent out shortly before the holidays with a suggestion that they be used on Christmas letters and packages. On May 31, 1932, the first financial report was submitted. The sale of seals brought to the Fund treasury $2,059.81. After paying the cost of printing and mailing, money was available for six loans of $200.00 each. One senior student from each of the six approved colleges was a recipient.

Since that time, through the Student Loan Fund, almost 200 students have been enabled to finish their training and take their places as osteopathic physicians. It is interesting to note that the Fund has never sustained a loss on any loan.

Over the years, more than one osteopathic physician has made the Fund his heir or the beneficiary of an insurance policy or has made an outright gift of money or securities during his lifetime. Chief among these is Dr. Edgar W. Culley of Melbourne, Australia, whose generous gifts throughout the history of the Fund have been of a substantial nature and have proved to be the spark plug for other contributions.

During the past 5 years members of the profession and the public at large have become acutely conscious of the necessity of basic research. The federal government and various independent agencies have stressed the necessity of research in poliomyelitis, cancer, and numerous other diseases. The osteopathic colleges have undertaken intensified programs of osteopathic research, but the expense involved has been a deterrent to the desired expansion of facilities.

Recognizing the importance of research to the future recognition of the osteopathic profession and knowing the cost of expansion, the Board of Trustees of the American Osteopathic Association, at its meeting in July, 1949, voted to include research in the Christmas Seal program, allotting 90 per cent of the proceeds from the sale of Christmas Seals to research and leaving 10 per cent to the Student Loan Fund.

Throughout the years the research program has been conducted by means of grants, derived from dues income, to the Research Fund. The expansion of osteopathic research in the future must be of a substantial nature and it is the obligation of the osteopathic profession and the patients deriving the benefits of osteopathic care to subsidize this research at least until such time as government grants and gifts from private endowments in sufficient amounts are available.

The sale of Christmas seals in large quantities will make it possible to use general funds for other activities of the Association which are urgently needed. Success of the sale of Christmas seals for osteopathic education and research will depend in a great measure upon the members of the profession individually. Each member should purchase seals and distribute them to friends and patients, who will welcome the opportunity to help once the need is explained to them.

The purchase and use of seals will not only materially assist osteopathic education and research, but will be of considerable value public relation-wise. Every member of the American Osteopathic Association should consider himself a committee of one to undertake a substantial sale of seals during the holiday period.

E. H. McKenna, D.O.

Department of Professional Affairs

ALLAN A. EGGLESTON, D.O.
Chairman
Montreal, Canada

COMMITTEE ON SPECIAL MEMBERSHIP EFFORT

STEPHEN B. GIBBS, D.O.
Chairman
Coral Gables, Florida

YOU BELONG

The title of this membership message gives recognition to the fact that the osteopathic physician who reads it is an active participant in organized osteopathy. The question which it may evoke: "Why try to get a message to me about membership?—I belong," is a good one and should be answered.

The people most enthusiastic about any activity are those who have had personal contact in that activity. They may not be directors or hold office. Maybe they are just members or stockholders and as such are satisfied to lend support in whatever manner their membership or holdings indicate. Your annual membership card indicates that you not only belong to, but also you hold an annual participating share in the American Osteopathic Association. The nice part is that this share of "stock" pays dividends far beyond reasonable expectation, considering the amount of the original investment.

I have heard very few men or women say, "I belong because I'm told they need my support." On the other hand, many have said they belong because it has been proved over the years that the annual dues fee was a good investment. Space here will not permit listing the ever growing benefits which accrue to the members of the American Osteopathic Association. If space was available, it would not be necessary. You know what those benefits are.

Does the nonmember know about the benefits or "dividends"? A small number do know but are so self-centered and selfish that they do not care. These few are willing to derive benefits from the efforts of others. We should not concern ourselves too much with this small group.

I am convinced that the great majority of nonmembers realize that they should help themselves and others by keeping the "participating shares" producing good dividends. All they need is a reminder from one who knows—a reminder to get in and help. Letters and articles in this or any other publication are not enough to arouse interest of sufficient degree to produce a positive reaction. This then is where you, a member, can help that nonmember you know. *You belong.* You know what it means to you and to your fellow members.

Why not spend a few minutes with each nonmember you know or even with those you don't know. The story of the value of membership is so easy to tell, easy because it is a positive story of progress—a progress that has been made without nonmember help but which could be so much greater if the size of the nonmember list was reduced to a minimum. Why not apply the Golden Rule and do for others what you have either had done for you or have done for yourself? You will enjoy the experience whenever you visit a nonmember so why not give yourself the pleasure of making that visit now.

H. Dale Pearson, D.O.
Past President, A.O.A.

MEMBERSHIP REPORT AS OF OCTOBER 1, 1950

Membership Count, September 1, 1950		7,893
Applications received in September, 1950	28	
Graduates licensed in September, 1950	96	
	124	
Deaths in September, 1950	3	
Gain in September, 1950		121
Membership Count, October 1, 1950		8,014

HONOR ROLL

W. A. Jones — Luther W. Swift

Dorothy J. Marsh

Department of Public Affairs

JOHN W. MULFORD, D.O.
Chairman
Cincinnati

BUREAU OF PUBLIC EDUCATION ON HEALTH

JOHN P. WOOD, D.O.
Chairman
Birmingham, Mich.

UNITED STATES CIVIL DEFENSE

The United States government, realizing that it is no longer free from the danger of a sudden devastating attack by a foreign country, has begun the development of a plan for civil defense. A plan has been presented to the President which recommends the establishment of a basic civil defense law, a civil defense administration and the appointment of an administrator. Every member of the osteopathic profession should be familiar with the development of the National Security Program, especially that portion of the program which establishes the method whereby health and medical services would be provided in time of an emergency. A manual, the "United States Civil Defense," National Security Resources Board Document 128, which outlines the national plan for civil defense, is available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. This manual was submitted to Congress by the President on September 18, 1950, the same day on which an Executive Committee of the Governors' Conference announced that each state should immediately set up a civil defense program.

A civil defense program is necessary for the adequate national security of the United States, and, along with a military defense, becomes an integral part of the well-rounded defense program. Civil defense may be defined as the protection of the home front by civilians acting under civil authority to minimize casualties and war damage and to preserve maximum civilian support in the war effort.

Both federal and state governments have responsibilities in the development of a national civil defense plan. The federal government is responsible for the establishment of the general policy and the over-all plan and for the issuance of informational and educational material. The federal government will deal directly with each state through its governor, who is responsible for providing leadership and supervision in all state planning for civil defense. The state becomes the key operating unit and is also responsible for interstate planning. Each city and county should adopt appropriate ordinances for the establishment and operation of its civil defense system. Basic operating responsibility for civil defense ultimately rests upon the individual and his local government. Only through the participation of hundreds of thousands of individual citizens will the establishment of a civil defense program become a reality.

The civil defense plan which has been prepared is divided into three parts. Part one deals with policy, basic concepts, and basic responsibilities. Part two presents the specific functions of civil defense necessary to fulfill the strategic concepts. Part three translates policy and concepts into operation. Every person and every community has a part to play in the civilian defense program. A civilian defense program must be in constant readiness because for the first time in the history of this country a sudden attack with little or

no warning is possible. Civil defense will spell the difference between defeat and slavery for the people and victory in a war thrust upon us.

Legislation is one of the first considerations of every state in initiating a civil defense plan to delineate clearly the authority and responsibilities of the governor in civil defense affairs. A suggested model state civil defense act has been prepared and is included in the manual "United States Civil Defense," referred to above (pp. 135-149). The act provides for the establishment of a state civil defense agency and for the appointment of a director of civil defense. The act further provides for a civilian defense advisory council composed of representatives of each of the major state organizations and professional health experts whose duty it is to advise the governor on all matters pertaining to civil defense. In Michigan, two osteopathic physicians now serve on the technical advisory committee on health and welfare of the Michigan Defense Council. Members of the osteopathic profession should be represented on the technical advisory committees on health and welfare in all states. The osteopathic profession offers its full services in time of emergency, and through adequate representation these services will be assured to the people.

The various functions which will have to be provided in a civilian defense program have been divided into the following classifications: (1) air raid warning, (2) shelter protection, (3) evacuation, (4) warden service, (5) mutual aid and mobile support, (6) fire services, (7) law enforcement service, (8) health service, (9) emergency welfare service, (10) engineering service, (11) rescue service, (12) communications, (13) transportation, (14) plant protection, (15) supply service, (16) civilian auxiliaries to military activities, and (17) personnel service. The osteopathic profession is primarily concerned with the problems involved in providing adequate medical and health services to the people under the civilian defense plan. In the manual, "United States Civil Defense," consideration is given to the general requirements necessary for the protection of the people in the time of an emergency.

Under a civil defense program, the existing health agencies and individual professional and technical experts to a considerable degree must remain responsible for the maintenance of health services during an emergency or war period because of the technical and professional services required. Utilizing existing health agencies will also avoid an unnecessary duplication of health agencies. It has been recommended that the state health officer be placed in charge of all state civil defense health and medical services, and that counties and cities appoint local health officers in the same manner. A program of civil defense must include provision for the relief of suffering immediately after a civilian wartime disaster, provisions for emergency lifesaving measures, and for the preservation or restoration of normal peacetime health services.

New medical and health problems may be created by an enemy attack using new technological weapons producing radiation and chemical or bacteriological contamination. Special training for professional, technical, and auxiliary lay personnel will be necessary to prepare for any eventuality. An extensive organization will be necessary to provide adequate professional and technical personnel and to supply hospitals and related facilities for the care of the many thousands of casualties which could occur among the civilian inhabitants of a large city. Many auxiliary volunteer workers will be needed in order to supplement services of available professional and technical personnel. The services of osteopathic physicians will be needed in a civil defense plan, and under such a plan complete recognition should be given to the osteopathic school of medicine. Osteopathic physicians and surgeons have been trained in the use of drug therapy and operative surgery and should be permitted to render complete health care. In states where limitations exist in the law upon the right of doctors of osteopathy to use drugs or surgery, the removal of the limitations should be a part of the over-all civil defense program.

In considering the problems involved in providing adequate medical and health services in the time of an emergency, individual problems have been considered and classified separately in Chapter 16, "Health Services," of the manual (pp. 59-69). Additional specific technical information concerning each of the functions considered below will be printed at a later date in manuals and made available through the office of the Superintendent of Documents of the federal government. The following separate problems must be considered in the organization of health and medical services in time of an emergency.

1. *First-Aid and Ambulance Service.*—In certain areas designated by state civil defense authorities, a complete system of first-aid stations should be devised. Physicians, both osteopathic and allopathic, dentists, pharmacists, first-aid workers, litter bearers, and nurses should be assigned to these stations in the advance planning. These stations, in addition to providing emergency lifesaving measures, would also serve as ambulance stations.

2. *Emergency Hospital Systems.*—Three types of hospitals have been recommended: (a) Improvised hospitals. It will be necessary to conduct a survey of the available space which could be converted to hospital use. In general, school buildings, hotels, and apartments will be converted for hospital use. It will be necessary to have emergency equipment, such as beds, instruments, and medical supplies available for ready shipment from storage points to equip these improvised hospitals. (b) Undamaged existing hospitals. It has been recommended that these facilities be reserved and staffed for casualties which require major surgical or medical procedures. (c) Existing hospitals in nearby and distant communities. These hospitals would be used for the treatment of patients who had been exposed to dangerous amounts of radiation but with no immediate injuries who could be transported to distant hospitals in order that adequate treatment might be provided them at the onset of radiation sickness.

3. *Casualty Services.*—Surgical teams, including shock-treatment and burn-treatment units, are to be organized on a local basis. These teams would include general surgeons, nurses, and anesthetists for providing casualty services.

4. *Health Supplies.*—A system of distribution of health supplies including drugs, chemicals, instruments, equipment, antibiotics, biologicals, and surgical textiles should be established. Federal stock-piling of additional supplies has been planned which will be readily accessible by rail, truck, and air shipping facilities to areas in critical need in time of a major atomic bomb attack on a large metropolitan area.

5. *Blood Services.*—The American National Red Cross has been assigned the major responsibility for national coordination of donor recruitments, blood procurement, storage, processing, and preparation for shipment. Osteopathic physicians in localities where there are no blood banks should take steps to see that one is promptly established and coordinated into the national blood program.

6. *Laboratory Services.*—Laboratory services will be necessary for blood matching, clinical, public health, and sanitation laboratory measures and for functions relating to monitoring of biological and chemical warfare.

7. *Sanitation Services.*—Sanitation services are vital to the preservation of the health of the surviving population after a disaster. Adequate measures must be taken to insure sanitary water and food conditions and to provide for the disposal of sewage and waste. Decontamination measures relating to atomic, biological, or chemical warfare will also be necessary.

8. *Nutritional Services.*—Emergency diets and food priority systems will have to be planned and undoubtedly milk rationing will be a most urgent consideration.

9. *Medical Services.*—Under this category will be included industrial health services, mental health services, obstetrical services, pediatric services, and emergency medical care. Plans must be made to insure a reasonable degree of care for people who are not casualties of the disaster but were already ill.

10. *Veterinary Services.*—Veterinary services will also be necessary to supplement the other services to insure the protection of food animals, the inspection of meat, and in the management of problems created by pets and other small animals.

11. *Records.*—Local civilian defense organizations must keep uniform records. It is recommended that these records be a part of the health department vital statistics.

12. *Morgue Services.*—It is imperative that adequate morgue and identification facilities be established. This activity will also be under the general supervision of the local civil defense health services.

13. *Health Transportation Services.*—Adequate means of transportation for all health services must be provided, including first-aid stations and emergency ambulances, morgue trucks, casualty evacuation and hospital patient evacuation vehicles and transportation for essential health personnel and supplies.

Each of these functions constitutes a part of the over-all plan which must be established to avoid panic and to keep casualties at a minimum. Detailed planning will be required by each local civil defense agency to ascertain that it can adequately meet the problems which will be presented in time of an emergency. Members of the osteopathic profession should lend their efforts wherever possible to insure that an adequate local civil defense plan is formulated.

Persons who participate in the program for civil defense will become members of the United States Civil Defense Corps, and will receive training in general civil defense organization and administration. It will be necessary that additional technical and professional courses be provided for key personnel in the various specialized fields. Some members of the osteopathic profession have already received instructions in the medical aspects of atomic warfare. Other training courses will be offered later. Courses in radiological safety and monitoring and biological warfare monitoring will also be given to familiarize technical personnel with the new problems which will be met in time of an atomic attack. Special methods of treatment, particularly the mass treatment of burns, must be understood by all physicians. When the program is fully under way, it is anticipated that several million Americans will be taught civil defense first-aid measures. All members of the United States Civil Defense Corps should take these courses.

CONCLUSION

Brief consideration has been given to some of the problems presented in the field of health and medical services in the time of disaster. The maintenance of usual health services during wartime must, to a great extent, fall upon members of the osteopathic profession along with practitioners of other schools of the healing art. Members of the osteopathic profession should volunteer their services wherever needed for the establishment of a civil defense plan. Osteopathic physicians in several states are actively participating in the establishment of civil defense plans as they relate to health and medical services. Members of the osteopathic profession should be represented on the Civil Defense Advisory Council in each state in which defense legislation is enacted. In 1951, forty-four legislatures will meet to consider legislation requiring the establishment of a state organization for civil defense. It is the duty of every physician to participate wherever his services may be of benefit. Your attention is again called to the desirability of every physician becoming well informed upon the subject of civilian defense by procuring a copy of National Security Resources Board Document No. 128, entitled "The United States Civil Defense," which may be procured from the United States Government Printing Office, Superintendent of Documents, Washington, D. C., at a cost of twenty-five cents.

Department of Public Relations

CHESTER D. SWOPE, D.O.
Chairman
Washington, D. C.

DOCTOR DRAFT REGISTRATION

On October 6, 1950, the President by Proclamation fixed October 16, 1950, as the first special registration date under the doctor draft law and empowered the Director of Selective Service to fix subsequent dates.

The Proclamation does not require the registration of doctors of osteopathy. In brief, the Proclamation does three things:

1. It fixes October 16, 1950, as the special registration date for M.D.'s, dentists, and veterinarians included in the first or second of the priorities defined in the Law, who are under 50 years of age;

2. It authorizes and *directs* the Director of Selective Service to fix the date or dates, such dates not to be later than January 16, 1951, for the special registration of M.D.'s, dentists, and veterinarians included in the third or fourth of the priorities defined in the Law, who are under 50 years of age;

3. It *authorizes* the Director of Selective Service to fix the date or dates for special registration of all other persons who are subject to registration under the Law. This would permit the Director to fix a date and require the special registration of D.O.'s.

The Department of Defense on October 10, 1950, asked the Selective Service System to induct a total of 922 medical doctors, 500 dentists, and 100 veterinarians in November, December, and January, for assignment to the Department of the Army.

Induction quotas were specified as follows: 300 doctors of medicine by November 15; 300 doctors of medicine, 300 doctors of dental surgery or doctors of medical dentistry, and 50 doctors of veterinary medicine by December 15; 322 medical doctors, 200 doctors of dental surgery or medical dentistry, and 50 doctors of veterinary medicine by January 15.

The Department of the Navy and the Department of the Air Force have indicated that present plans do not call for submission of requisitions in these categories.

By Executive Order dated October 4, 1950, the President pursuant to the doctor draft law established a National Advisory Committee on the Selection of Doctors, Dentists, and Allied Specialists to advise the Selective Service System. State committees and subcommittees are being established for the same purpose. It is contemplated that advice rendered regarding deferability of members of any of the categories will be rendered only with representation of the profession involved.

By Executive Order dated October 11, 1950, the President added a new part to the Selective Service regulations (Part 1650), and provided (Sec. 1650.11 (g)) that in classifying registrants under the doctor draft provisions "the local board shall give consideration to but shall not be bound by any advice offered by any committee established pursuant to" the doctor draft law.

The Presidential Proclamation setting the first registration reads as follows:

SPECIAL REGISTRATION
BY THE PRESIDENT OF THE UNITED STATES
OF AMERICA
A PROCLAMATION
(# 2906)

WHEREAS the act of September 9, 1950, Public Law 779, Eighty-first Congress, amends section 4 of title 1 of the Selective Service Act of 1948 (62 Stat. 604), as amended, by adding thereto subsection (i), which contains, in part, the following provisions:

"(i) (1) Notwithstanding any other provision of this title, except subsections 6(j) and 6(o), the President is authorized to require special registration of and, on the basis of requisitions submitted by the Department of Defense and approved by him, to make special calls for male persons qualified in needed—

"(A) medical and allied specialist categories who have not yet reached the age of fifty at the time of registration, and

"(B) dental and allied specialist categories who have not yet reached the age of fifty at the time of registration.

Persons called hereunder shall be liable for induction for not to exceed twenty-one months of service in the Armed Forces. No such person who is a member of a reserve component of the Armed Forces shall, so long as he remains a member thereof, be liable for registration or induction under this subsection, but nothing in this subsection shall be construed to affect the authority of the President under any other provision of law to call to active duty members and units of the reserve components. No person in the medical, dental, and allied specialist categories shall be inducted under the provisions of this subsection after he has attained the fifty-first anniversary of the date of his birth.

"(2) In registering and inducting persons pursuant to paragraph (1) of this subsection, the President shall, to the extent that he considers practicable and desirable, register and induct in the following order of priority:

"First. Those persons who participated as students in the Army specialized training program or similar programs administered by the Navy, and those persons who were deferred from service during World War II for the purpose of pursuing a course of instruction leading to education in one of the categories referred to in clauses (A) and (B) of paragraph (1) of this subsection, who have had less than ninety days of active duty in the Army, the Air Force, the Navy, the Marine Corps, the Coast Guard, or the Public Health Service subsequent to the completion of or release from the program or course of instruction (exclusive of the time spent in postgraduate training).

"Second. Those persons who participated as students in the Army specialized training program or similar programs administered by the Navy, and those persons who were deferred from service during World War II for the purpose of pursuing a course of instruction leading to education in one of the above categories, who have had ninety days or more but less than twenty-one months of active duty in the Army, the Air Force, the Navy, the Marine Corps, the Coast Guard, or the Public Health Service subsequent to the completion of or release from the program or course of instruction (exclusive of the time spent in postgraduate training).

"Third. Those who did not have active service in the Army, the Air Force, the Navy, the Marine Corps, the Coast Guard, or the Public Health Service subsequent to September 16, 1940.

"Fourth. Those not included in the first and second priority who have had active service in the Army, the Air Force, the Navy, the Marine Corps, the Coast Guard, or the Public Health Service subsequent to September 16, 1940. * * *"

AND WHEREAS section 6 of the aforesaid act of September 9, 1950, reads as follows:

"For the purposes of this Act, the term 'allied specialist categories' shall include, but not be limited to, veterinarians, optometrists, pharmacists, and osteopaths."

AND WHEREAS title I of the Selective Service Act of 1948 contains, in part, the following provisions:

"SEC. 6.

(k) No exception from registration, or exemption or deferment from training and service, under this title, shall continue after the cause therefor ceases to exist."

* * * * *

"SEC. 10. * * * *

(b) The President is authorized—

(1) to prescribe the necessary rules and regulations to carry out the provisions of this title;

* * * *

(5) to utilize the services of any or all departments and any and all officers or agents of the United States, and to accept the services of all officers and agents of the several States, Territories, and possessions, and subdivisions thereof, and the District of Columbia, and of private welfare organizations, in the execution of this title;

* * * *

(c) The President is authorized to delegate any authority vested in him under this title, and to provide for the subdelegation of any such authority."

AND WHEREAS bachelors of medicine, doctors of medicine, doctors of dental surgery, doctors of medical dentistry, doctors of veterinary surgery, and doctors of veterinary medicine, are urgently needed for service in the armed forces of the United States:

NOW, THEREFORE, I, HARRY S. TRUMAN, President of the United States of America, acting under and by virtue of the authority vested in me by title I of the Selective Service Act of 1948, as amended, do proclaim the following:

1. Every male person who participated as a student in the Army specialized training program or any similar program administered by the Navy, or was deferred from service during World War II for the purpose of pursuing a course of instruction leading to education in a medical, dental, or allied specialist category, and has had less than twenty-one months of active duty in the Army, the Air Force, the Navy, the Marine Corps, the Coast Guard, or the Public Health Service subsequent to the completion of, or release from, such program or course of instruction (exclusive of time spent in postgraduate training), and who, on the day or any of the days hereinafter fixed for his registration (a) shall have received from any school, college, university, or similar institution of learning one or more of the degrees of bachelor of medicine, doctor of medicine, doctor of dental surgery, doctor of medical dentistry, doctor of veterinary surgery, and doctor of veterinary medicine, (b) is within any of the several States of the United States, the District of Columbia, the Territory of Alaska, the Territory of Hawaii, Puerto Rico, or the Virgin Islands, (c) is not a member of any reserve component of the armed forces of the United States, and (d) shall not have attained the fiftieth anniversary of the day of his birth is required to and shall on that day or any of those days present himself for and submit to registration before a duly designated registration official or selective service local board having jurisdiction in the area in which he has his permanent home or in which he may happen to be on that day or any of those days.

2. The special registration of the male persons required to submit to registration by paragraph numbered 1 hereof shall take place in the several States of the United States, the District of Columbia, the Territories of Alaska and Hawaii, Puerto Rico, and the Virgin Islands between the hours of 8:00 a.m. and 5:00 p.m. on the day or days hereinafter designated for their registration as follows:

(a) Persons who shall have received any of the degrees above referred to on or before October 16, 1950, shall be registered on Monday, the 16th day of October, 1950.

(b) Persons who receive any of the degrees above referred to after October 16, 1950, shall be registered on the day they receive any such degree, or within five days thereafter.

(c) Persons who shall have received any of the degrees above referred to and who enter any of the several States of the United States, the District of Columbia, the Territory of Alaska, the Territory of Hawaii, Puerto Rico, or the Virgin Islands after October 16, 1950, shall be registered on the day of such entrance, or within five days thereafter.

3. Every male person who has not had active service in the Army, the Air Force, the Navy, the Marine Corps, the Coast Guard, or the Public Health Service subsequent to September 16, 1940, and every male person not included in the first or the second of the priorities defined in section 4(i)(2) of the Selective Service Act of 1948, as amended, who has had active service in the Army, the Air Force, the Navy, the Marine Corps, the Coast Guard, or the Public Health Service subsequent to September 16, 1940, who on the day or any of the days hereafter fixed by the Director of Selective Service for his registration (a) shall have received from a school, college, university, or similar institution of learning one or more of the degrees of bachelor of medicine, doctor of medicine, doctor of dental surgery, doctor of medical dentistry, doctor of veterinary surgery, and doctor of veterinary medicine, (b) is within any of the several States of the United States, the District of Columbia, the Territory of Alaska, the Territory of Hawaii, Puerto Rico, or the Virgin Islands, (c) is not a member of any reserve component of the armed forces of the United States, and (d) shall not have attained the fiftieth anniversary of the day of his birth is required to and shall on that day or any of those days present himself for and submit to registration before a duly designated registration official or selective service local board having jurisdiction in the area in which he has his permanent home or in which he may happen to be on that day or any of those days.

4. The Director of Selective Service is hereby authorized and directed to fix the date or dates for the special registration required under paragraph numbered 3 hereof: *Provided*, that the date or dates so fixed shall be not later than January 16, 1951.

5. The Director of Selective Service is hereby authorized to require special registration of, and fix the date or dates of registration for, all other persons who are subject to registration under section 4(i) of the Selective Service Act of 1948, as amended, and who are not required to register under or pursuant to this proclamation.

6. All orders and directives of the Director of Selective Service issued pursuant to paragraph numbered 4 or paragraph numbered 5 hereof shall be published in the Federal Register.

7. (a) A person subject to registration under or pursuant to this proclamation who, because of circumstances beyond his control, is unable to present himself for and submit to registration during the hours of the day or any of the days fixed for registration shall do so as soon as possible after the cause for such inability ceases to exist.

(b) Every person subject to registration under or pursuant to this proclamation who has registered in accordance with Proclamation No. 2799 of July 20, 1948, issued under the Selective Service Act of 1948, as amended, and the regulations prescribed thereunder, shall, notwithstanding such registration, present himself for and submit to registration as required by or pursuant to this proclamation.

(c) The duty of any person to present himself for and submit to registration in accordance with Proclamation No. 2799 of July 20, 1948, issued under the Selective Service Act of 1948, as amended, and the regulations prescribed thereunder, shall not be affected by this proclamation.

8. Every person subject to registration under or pursuant to this proclamation is required to familiarize himself with the rules and regulations governing such registration and to comply therewith.

9. I call upon the Governors of each of the several States, the Territories of Alaska and Hawaii, Puerto Rico, and the Virgin Islands and the Board of Commissioners of the District of Columbia, and all officers and agents of the United States and all officers and agents of the several States, the Territories of Alaska and Hawaii, Puerto Rico, the Virgin Islands, and the District of Columbia, and political subdivisions thereof, and all local boards and agents thereof appointed under the provisions of title I of the Selective Service Act of 1948, as amended, or the regulations prescribed thereunder, to do and perform all acts and services necessary to accomplish effective and complete registration.

10. In order that there may be full cooperation in carrying into effect the purposes of section 4(i) of title I of the Selective Service Act of 1948, as amended, I urge all employers and Government agencies of all kinds—Federal, State, territorial, and local—to give those under their charge sufficient time in which to fulfill the obligations of registration incumbent upon them under the said Act and under or pursuant to this proclamation.

IN WITNESS WHEREOF, I have hereunto set my hand and caused the seal of the United States of America to be affixed.

DONE at the City of Washington this sixth day of October in the year of our Lord nineteen hundred and fifty, and of the Independence of the United States of America the one hundred and seventy-fifth.

(SEAL)

HARRY S. TRUMAN

By the President:

JAMES E. WEBB
Acting Secretary of State

Current Medical Literature

ONE HUNDRED PER CENT OXYGEN IN THE TREATMENT OF ACUTE MYOCARDIAL INFARCTION AND SEVERE ANGINA PECTORIS

In an attempt to determine whether the administration of 100 per cent oxygen is beneficial in relieving severe paroxysms of angina pectoris and intractable pain accompanying acute myocardial infarction without arterial anoxemia, Henry I. Russek, M.D., and others studied five patients with angina pectoris. They report their findings in the September 30, 1950 issue of the *Journal of the American Medical Association.*

The patients to be studied were chosen from a group of 100 seamen suffering from angina pectoris. Screening was accomplished by use of the Master two-step test in which the patient climbs up and down a two-step staircase between 20 and 30 times depending on age, weight, and sex. For purposes of this study five patients were selected whose electrocardiographic response (taken at 2 minute intervals for 10 succeeding minutes following the two-step test) was constantly positive.

In order to establish a control, a number of studies were made with the five patients wearing an oronasal type oxygen mask regulated to admit room air. Each patient was required to perform one exercise test per 24 hour period at precisely the same time each day before the same observers. After enough information had been acquired to determine a response characteristic for each patient, the identical exercises were given under similar circumstances with the face mask regulated to deliver 100 per cent oxygen.

Findings showed that in all five instances the 100 per cent administration of oxygen had no effect in regulating the onset and duration of pain or the electrocardiographic changes caused by the exercise. In four of the cases the administration of oxygen resulted in a more pronounced and persistent electrocardiographic change. In contrast, the administration before the test of a 1/150 grain tablet of nitroglycerin stopped the development of anginal pain and greatly modified electrocardiographic response. This reaction suggested that hyperoxygenated blood may prevent or reverse reactive hyperemia evoked by myocardial anoxia while nitroglycerin increases the response. Hence, the administration of 100 per cent oxygen to patients with normal oxygen saturation of arterial blood may actually be undesirable.

In cases where acute myocardial infarction has resulted in secondary generalized arterial anoxemia, the use of oxygen is strongly recommended. It is also recommended in cases of dyspnea, cardiac asthma, pulmonary edema, Cheyne-Stokes respiration, and cyanosis. However, the authors conclude that the indiscriminate use of oxygen serves no worthwhile purpose and only tends to increase the patient's discomfort and anxiety.

MODERN TREATMENT OF CHRONIC OSTEOMYELITIS WITH TOPICAL DETERGENT ANTIBIOTIC THERAPY

In *Surgery, Gynecology and Obstetrics,* September, 1950, Edwin J. Grace, M.D., and Vernon Bryson, Ph.D., review 45 cases of patients with chronic osteomyelitis treated with penicillin parenterally and in surface active solution. As a result of this treatment they found that 69 per cent of the patients had a complete arrest of the disease for periods ranging from 1 to nearly 5 years. Hospitalization time was reduced to an average of 10 days and the patients were ambulatory at the end of treatment.

The patients ranged in age from 14 to 70 years. Thirty-three had undergone surgery without lasting benefit. Infection was localized in the femur; tibia or fibula; humerus; scapula; mandible; sacroiliac joint; metatarsals, metacarpals, and phalanges; sacrum; hip; frontal bone; os calcis; and ilium. Several patients suffered multiple lesions.

Staphylococci were found in 43 patients.

Treatment centered around four different therapeutic methods. All were based on the fundamental principle of direct contact of the detergent-antibiotic solution with the infecting organism. The most satisfactory method involved inserting a probe along the sinus tract to the area which led to the diseased bone. The bone was then exposed and the point of maximum necrosis determined. To permit the insertion of a T tube, a circular opening was made in the bone with a tunnel on either side along the long axis of the bone. Antibiotic detergent (aerosol W/W and penicillin) was puddled about the infected area before and after drilling, and more of the solution was injected through the tube. The wound was closed without drainage and 3 to 5 milliliters of the solution were injected through the catheter of the tube every 4 hours for 10 days.

Because of the relative isolation of infected tissues, chemotherapy is sometimes difficult. Antibiotics administered parenterally cannot reach infected areas in the long bones in any quantity. Likewise, bacteria situated subperiosteally are protected from parenterally administered agents in varying degrees, depending upon the extent of avascularity. When draining sinuses exist, the simplest treatment is to introduce the antibacterial agent directly into the sinus cavity as described. If the drainage point and the infective area are separated anatomically, x-ray can be used to determine the focus of the disease. Experiments suggest that isolated pathogens may be reached more readily by introducing penicillin in a wetting agent. However, regard must be given to the clinical possibility of undue hemolysis or lipemia. Under specific circumstances penicillin activity is increased by both zephiran and aerosol O.T. The potential affinity of aerosol wash or aerosol O.T. for the fatty elements in bone marrow and pus may be instrumental in promoting contact between antibiotic and isolated bacteria.

Another difficulty of chemotherapy is the development of drug-resistant bacterial strains. However, the topical administration of multiple chemotherapy as exemplified by penicillin in zephiran chloride or aerosol O.T. theoretically provides a method for reducing the incidence of resistant strains. This hypothesis is based on the observation that penicillin resistant organisms are not found as frequently when bacteria are grown in the presence of another inhibitory agent.

Whenever possible, conservative treatment with chemotherapy should precede or even exclude extensive surgery in cases of chronic osteomyelitis.

EVOLUTION OF NEUROLOGIC SIGNS OF EARLY ANTERIOR POLIOMYELITIS

Eleven neurologists, working in shifts of 6 hours around the clock for 30 days, studied carefully and frequently the onset and progression of the signs of poliomyelitis in thirty cases. Lewis J. Pollock, M.D., and his coworkers report their findings in the *American Journal of Diseases of Children* for June, 1950.

Nuchal rigidity and direct Brudzinski and Kernig signs are found in all cases of meningitis. Nuchal rigidity is found in 92.4 per cent of poliomyelitis, but differed from meningitis in that the former allowed more flexion of the head before rigidity set in. The direct Brudzinski sign was present in only 37 per cent and the Kernig in 39 per cent. Most of the Kernig signs were in cases over 100 hours old, and it is pointed out that in legs that eventually became paretic, there were fewer positive signs.

Muscle paralysis was studied by testing muscles on 3,192 cases which were destined to become paralyzed and 5,922 which developed only weakness. Weakness was found as early as 6 hours from onset, with the peak of total weakness at 144 hours. All weakness findings were very variable in regard to time. Paralysis occurred as early as 18 hours after onset and was also quite variable.

In muscles destined to progress to paralysis, 91 per cent showed absence of deep reflexes. The earlier the reflex was

found to be absent, the greater the chance for the muscle group to become paralyzed. Abdominal reflexes disappeared by the one-hundredth hour in 85 per cent of the cases which went on to lower extremity paralysis. Incidence of the absence of abdominal reflex was less in the weaker forms of poliomyelitis. Hyperactivity of the abdominal reflex occurred in 42 per cent when only the upper extremity was to become involved and never when only the lower extremities.

Plantar reflexes disappeared in 35 per cent of severely paralyzed lower extremities, but the findings fluctuated greatly. They were never absent in a purely upper extremity paralysis or when paralysis did not occur. The writers point out that findings of the Babinski sign were "fleeting, inconstant and unrelated".

On the basis of failure to find any relationship between the deep reflexes, abdominal reflex, and the Babinski sign, they felt justified in concluding that poliomyelitis is not an upper motor neuron lesion.

Direct myotatic irritability was found to be increased more in paralyzed muscles of the upper extremity than in the lower extremity and increased in a greater percentage of paralyzed muscles than in the nonparalyzed ones.

ARNOLD MELNICK, A.B., M.A., D.O.

CRYPTOCOCCOSIS: A REVIEW WITH SPECIAL ATTENTION TO APPARENT ASSOCIATION WITH HODGKIN'S DISEASE

Benjamin R. Gendel, M.D., and others review 165 cases of cryptococcosis, a systemic fungus infection, and report the salient features of the disease in the *American Journal of Medicine,* September, 1950.

The etiological organism is Cryptococcus neoformans, a budding fungus similar to Blastomyces but which does not produce mycelia on artificial culture media.

Though most cases are reported from the United States the disease is world-wide in distribution and was once called European blastomycosis. Transmission from man to man is not believed to occur and there is no evidence to demonstrate transmission from infected animals to man. All races are susceptible and there is a definite predilection for males.

Involvement of the central nervous system is by far the most common type of infection and this system may be involved alone or as part of a generalized infection. Diffuse granulomatous meningitis, perivascular involvement with cortical granulations or cysts, or deep cortical lesions may be present. The clinical picture is that of a low-grade meningoencephalitis with signs and symptoms of increased intracranial pressure. Headache, drowsiness, and vomiting are common and neck rigidity, opisthotonis, papilledema, amblyopia, diplopia, nystagmus, and paralysis are often noted. Brain tumor with localizing symptoms may be simulated. Psychosis and cranial and peripheral nerve paralyses have been described and in the newborn multiple intracranial calcifications are often found. Pressure on the spinal fluid is increased. The fluid is usually clear. Average cell count is from 200 to 800 cells but may vary from normal to several thousand. The cells are usually lymphocytic although a neutrophilic pleocytosis sometimes occurs. The cryptococci are often mistaken for lymphocytes or erythrocytes. Budding forms are pathognomonic. A mixture of spinal fluid sediment and diluted India ink causes the organisms to stand out characteristically when examined microscopically. Culturing provides the most dependable diagnosis and can be accomplished in 4 to 8 days as the organism grows readily on ordinary media.

Involvement of the lungs may rarely occur alone, but is usually found with other manifestations; the lesions are either gelatinous masses or fibrotic granulomatous lesions. Skin lesions are generally part of a disseminated infection and most commonly is an acneiform eruption which may ulcerate and exude a purulent material containing the organisms. Localized involvements of muscle, tongue, soft tissues of the pelvis, nasopharynx, and elsewhere have been reported. Disseminated involvement may involve kidneys, spleen, liver, thyroid, testes, adrenals, ilium, etc.

The coexistence of cryptococcosis and Hodgkin's disease, which was found in 14 or 8.5 per cent of the cases reviewed, is much too frequent to be a matter of chance. Two possible explanations suggest themselves. Various writers have suggested that infection with cryptococci might occasionally cause tissue reaction which is similar to Hodgkin's disease. An alternative explanation for the association is that patients with Hodgkin's disease are prone to develop infections.

Prognosis is poor, central nervous system involvement being almost always fatal. Patients with localized forms occasionally recover but if the infection becomes disseminated death results. The localized pulmonary form has the best prognosis.

Treatment is unsatisfactory though some experimental evidence indicates that streptomycin may be of some value.

MORTON TERRY, B.A., D.O., M.Sc. (Ost.)

CLINICAL STUDIES WITH ACTH AND CORTISONE IN RENAL DISEASE

The dramatic effect which ACTH and cortisone exert on the course of a wide variety of systemic diseases of unknown origin, especially those in which an antigen-antibody type of reaction is believed to play an important etiological role, stimulated George W. Thorn, M.D., and others to investigate the possible beneficial effect of these hormones in patients with glomerular nephritis. They report their findings in the *Archives of Internal Medicine,* September, 1950.

Because of the natural tendency to spontaneous improvement of the disease it was difficult to evaluate the efficacy of ACTH in four cases of acute glomerular nephritis. Some temporary beneficial effect may have occurred but the evidence is not conclusive. It is postulated that the known power of ACTH to decrease inflammatory response may result in a long term benefit by decreasing the amount of glomerular damage due to inflammation but studies with large numbers of cases would be necessary to substantiate these claims. No conclusive evidence was found that ACTH or cortisone favorably affects the course of subacute or chronic glomerulonephritis after treatment of seven cases.

In the nephrotic syndrome cortisone exerted little effect in 2 cases but ACTH resulted in striking response in 4 cases. Dramatic increase in the excretion of sodium, chloride, and water with loss of edema and body weight occurred after as little as 2 days of ACTH administration. Proteinuria and the number of casts excreted decreased in 3 instances. Serum chloride decreased and carbon dioxide-combining power increased in 2 instances. There is no evidence that the improvement in the nephrotic syndrome in patients treated with ACTH is of a permanent nature, however.

Six patients with lupus erythematosus disseminatus demonstrated no significant renal changes with ACTH therapy though other evidences of activity of the disease were favorably affected.

Three patients with dermatomyositis in which proteinuria was present were treated with ACTH and cortisone. Although they otherwise improved generally there was no reduction in the albuminuria.

MORTON TERRY, B.A., D.O., M.Sc. (Ost.)

DETERMINATION OF THE OXYGEN CONTENT OF CAPILLARY BLOOD IN CONGENITAL HEART DISEASE

Writing in the July, 1950, issue of *Pediatrics,* Herbert N. Hultgren, M.D., and Adeline J. Hackett, B.S., report findings of their modification of the method of Lilienthal and Riley for determining oxygen content of capillary blood. They used the finger tip as blood source and with a glass-tip Luer syringe modified to fit the tip of a Roughton-Scholander pipet, they were able to collect small quantities of blood and measure its oxygen content to within 2.1 per cent or 0.4 volumes per cent.

The authors point out the value of the procedure by noting that their method was found to be accurate, quick, and of minimum disturbance to the subjects, chiefly congenital heart disease patients.

ARNOLD MELNICK, A.B., M.A., D.O.

DOES GLUTAMIC ACID ADMINISTRATION INFLUENCE MENTAL FUNCTION?

Thirty-three feebleminded patients with no epilepsy or neurologic disease, divided into matched test group and control group, were examined by Harold G. Loeb, Ph.D., and Read D. Tuddenham, Ph.D.

They write in *Pediatrics* for July, 1950, that each patient was examined before and after with a battery of psychological tests, including Stanford-Binet, Cornell-Coxe, Performance Ability Scale, Porteus Maze, Thurstone and Thurstone Primary Mental Abilities, and the Rorschach. The control group was given placebos and the test group the monosodium salt of l(+) glutamic acid, 24 grams daily for 17 weeks. As all the cases were in the same institution, both groups received identical treatment and handling except for this drug.

Statistical analysis of the control and experimental subjects revealed no significant difference and the authors conclude that no beneficial effect from the glutamic acid could be demonstrated. Comparison with other similar studies is made.

ARNOLD MELNICK, A.B., M.A., D.O.

Book Notices

SURGERY OF CATARACT. By Daniel B. Kirby, A.M., M.D., LL.D., Professor of Ophthalmology (former Chairman of the Department), College of Medicine, New York University; Attending Surgeon (former Director), Department of Ophthalmology, Bellevue Hospital; Surgeon, New York Eye & Ear Infirmary; Consulting Ophthalmic Surgeon, Manhattan Eye, Ear & Throat Hospital, St. Clare's Hospital, Department of Ophthalmology, and New Rochelle Hospital, Department of Ophthalmology; Former Associate in Ophthalmology, College of Physicians and Surgeons, Columbia University; Former Attending Surgeon, Institute of Ophthalmology, Presbyterian Hospital in the City of New York; and Fellow, The American College of Surgeons and The Pan-American Association of Ophthalmology. Cloth. Pp. 695, with illustrations. Price $30.00. J. B. Lippincott Company, East Washington Square, Philadelphia, 1950.

A complete study of the most worthwhile contributions to cataract surgery that have ever been made, this monograph is destined to become a classic. Beginning with the earliest known mention of cataract, in the Code of Hammurabi of 3,000 years ago, the author traces the historical background of present-day cataract surgery through the Greco-Roman period and the Middle Ages to the advances of the eighteenth and nineteenth centuries. The applicable basic sciences—embryology, anatomy, physiology, and pathology—and asepsis and antisepsis provide necessary knowledge for the ophthalmic surgeon, and are given particular consideration.

The greater part of the text is devoted to a synthesis of present-day technics, with emphasis on the author's own methods. Discission of the whole lens, the removal of soft cataract, and extracapsular extraction are outlined, and intracapsular extraction is explored in great detail. Kirby prefers the intracapsular technic himself but, as he states, "The author is catholic in his views of cataract surgery and does not think it justifiable to try, or to persist in trying, the intracapsular operation in all cases. The operations of discission, of linear extraction of soft cataract and of extracapsular extraction may be indicated, and will give better results when applied under certain conditions . . . . it is necessary to adapt one's ideas and maneuvers to the situation in hand and to vary them as indicated."

The pioneer work of Henry Smith and its application by Dutt and Fuchs, the advances made by Kalt, and the contributions of Knapp, Stanculeanu, Sinclair, Verhoeff, Elschnig, Arruga, Klein, and Barraquer are described and discussed. The handling of complications is especially considered. "If the surgeon is prepared to prevent difficult conditions and to handle them should they arise, the average case will be easy," the author states. Among the complications considered are general and focal infection, complications involving the cornea, those involving the iris, hemorrhage, uveitis, glaucoma, loss of vitreous gel and after-cataract, and the presence of fluid vitreous.

The use of glasses after the removal of the cataract is also given considerable attention. Tests for correction of astigmatism, the method of refraction, examinations for binocular coordination, correction and adaptation, prescription for lenses in binocular aphakia, special bifocals, and the role of the optician are discussed. An exhaustive classification of cataract is of course presented. Other chapters in the book are devoted to the preparation of the patient for surgery, preparation of the hospital and the surgical team, preoperative examination of the eye and prognosis for restoration of vision, traumatic cataract, and standards for judging the progress or the arrest of cataract. A chapter on the results of surgical removal of cataract completes the work.

The typography of the book is excellent. There are two columns to a page, printed on high grade paper. The numerous large illustrations are extremely distinct and comprehensible. Many of them are original, and these are depicted from the viewpoint of the surgeon rather than that of the observer, an innovation that should prove helpful to the surgeon and student.

The reviewer has only two faults to find with the book. One is that the legends accompanying the illustrations are printed in the same type as the text, which occasionally is confusing. The other is that the chapters have been poorly arranged. For example, The Thesis and Organization of the Book comes between The Development of Cataract Extraction and General Surgical Principles: it should have been placed in the introduction, where, indeed, some of its contents already are. These, however, are minor faults, and detract little if at all from a monumental work.

PRINCIPLES OF PUBLIC HEALTH ADMINISTRATION. By John J. Hanlon, M.S., M.D., M.P.H., Associate Professor of Public Health Practice, School of Public Health, University of Michigan, and Chief Medical Officer and Associate Chief of Party, Bolivia, The Institute of Inter-American Affairs. Cloth. Pp. 506, with illustrations. Price $6.00. The C. V. Mosby Company, 3207 Washington Blvd., St. Louis 3, 1950.

According to Hanlon—and any competent worker in the field will agree—it is no longer enough for a public health official to be a capable diagnostician and therapist. Public health administration has become too complex and involved for these qualifications to suffice. Today the public health official must be not only a capable physician, but an able personnel manager, budget director, public relations man, political scientist, sociologist, law expert, and engineer. Unfortunately too many public health officials never discover this until they are faced with an overwhelming situation. To help would-be public health administrators better prepare themselves for the job, Hanlon has written this excellent book outlining the fundamental aspects of public health administration. Although an ardent enthusiast for public health work, the author is objective in his presentation, pointing out disadvantages as well as advantages which he believes to exist.

Hanlon has divided the book into three parts. Part I is devoted to a discussion of the philosophical and historical aspects of public health. In Part II he takes up the administrative considerations in public health. Part III describes the pattern of public health activities in the United States. Hanlon's

writing style is simple and fluent. The book is further enhanced by the discrete use of charts and graphs for presenting statistical material and by an over-all pleasing typography.

Students of public health will find the entire book of vital interest. Established health officers and particularly administrators will probably be most interested in the chapters dealing with "Personnel Factors in Public Health," "Fiscal Management in Relation to Public Health," "Legal Considerations in Public Health," "Governmental Aspects of Public Health," and "Public Relations in the Public Health Program."

PRACTICAL GYNECOLOGY. By Walter J. Reich, M.D., F.A.C.S., F.I.C.S., Attending Gynecologist, Cook County Hospital; Professor of Gynecology, Cook County Graduate School of Medicine; Attending Gynecologist, Fantus Clinics of the Cook County Hospital; Assistant Professor of Gynecology, Chicago Medical School; Attending Gynecologist and Obstetrician, Grant Hospital; Attending Gynecologist, Fox River Tuberculosis Sanatorium; Consulting Gynecologist, Hazelcrest General Hospital, and Mitchell J. Nechtow, M.D., Associate Attending Gynecologist, Cook County Hospital and the Fantus Gynecologic Clinic; Assistant Clinical Professor of Gynecology, Cook County Graduate School; Associate in Gynecology and Obstetrics, Chicago Medical School; Attending Gynecologist and Obstetrician, Norwegian-American Hospital. Cloth. Pp. 449, with illustrations. Price $10.00. J. B. Lippincott Company, East Washington Square, Philadelphia, 1950.

As a result of increased knowledge in the field of gynecology, many patients who once required hospitalization are now being treated in the doctor's office as part of ordinary office routine. Frequently, however, the general practitioner, while having a fairly thorough knowledge of gynecology, has had little training in office procedure. To fill this need the authors have written "Practical Gynecology" based on their own observations and experiences in the gynecologic outpatient clinics at Cook County Hospital, Chicago. Although of equal interest to the student, intern, and resident, the book is designed primarily to meet the needs of the general practitioner.

The over-all arrangement of the book follows the authors' suggested order of examination: "When the patient walks in we give her what we call a 'head to toe objective survey,' to try to discern something which may be of aid in determining the diagnosis. Then she 'talks her story in her own words.' Many diagnoses are suggested just by the history and we have made it a habit to be good listeners." The patient is then given a complete physical examination to reveal any systemic causes for the gynecologic symptoms or extragynecologic lesions with symptoms which might mistakenly be attributed to gynecologic origin. The authors begin the gynecological examination per se with an examination of the breasts for possible malignancy. They also suggest the use of cytology and hanging drop examinations as routine procedure. After a careful study of the cervix, the examination is concluded with a vagino-abdominal examination and a routine rectoabdominal check.

A very important introductory chapter on the psychosomatics of gynecology, with particular emphasis on the psychosomatic approach to sexual problems, provides a sound basis for the suggested "Practical Approach to a Gynecologic Diagnosis," which describes general examination technics. The chapters which follow deal with the diagnosis and management of diseases of the female genitalia; with conditions such as backache, dyspareunia, and vaginismus; and with questions related to low fertility, sterility, contraception, and artificial insemination. The authors conclude the book with an excellent chapter on "Premarital Examination and Counsel." The section on counseling is particularly valuable because so many doctors either overlook or avoid this important part of any premarital examination.

Readability is aided by an easy, informal writing style and a large, well-spaced type face. Excellent explanatory photographs and diagrams, including fifty-five color plates, accompany the text. Reproduction is particularly good because of the heavy, high gloss paper. Numerous case histories are included to illustrate the authors' points. The general physician whose practice includes a fair proportion of gynecologic cases will find this book very worthwhile both for general reading and for reference.

DOCTOR A. T. STILL IN THE LIVING. His concepts and principles of health and disease compiled, edited and with an introduction by Robert E. Truhlar, D.O. Cloth. Pp. 154. Price $5.00. Published by Robert E. Truhlar, D.O., 31437 Shaker Blvd., Chagrin Falls, Ohio.

"The compilation of this volume was prompted by talks, over breakfast and luncheon tables at our conventions. Many of the older doctors expressed the feeling that there must be a greater 'spiritual understanding' of osteopathy in the profession. . . . This volume in a small measure will show the deep understanding and wisdom that Dr. Still had of disease. It is for posterity to review, consider, evaluate and meditate upon, for the development and improvement in the art of healing. These capsules of wisdom and knowledge must be preserved for those who come after us, they are the guideposts of the osteopathic way of life, just as they have been for us and others before us."

In these words Truhlar explains his reasons for undertaking this book. With the help of fellow physicians he has compiled over 1,500 representative quotations from the life and writings of Dr. Still. These he grouped rather loosely under twenty-three alphabetical headings from A to W. The result is a phenomenal collection of comments, suggestions, and advice which should be read by every osteopathic physician.

MANUAL OF RHEUMATIC DISEASES. By W. Paul Holbrook, M.D. and Donald F. Hill, M.D., Tucson, Arizona. Cloth. Pp. 182, with illustrations. Price $4.25. Year Book Publishers, Inc., 200 E. Illinois St., Chicago 11, 1950.

"In this book an attempt has been made to simplify and condense the practical information on rheumatic diseases so that it can be used quickly and easily as a guide to diagnosis and treatment by any interested physician. . . . Procedures of office and home practice are emphasized." The authors clearly state in their preface that they do not intend to cover all aspects of all rheumatic diseases or to discuss the rare forms in detail. To a large extent theories are omitted. Readers who wish more detail should consult larger texts on the subject; this small 182-page book is for practical application only.

The authors point out in the first chapter that approximately seven and one-half million people in the United States suffer from some form of chronic rheumatic disease. This is ten times as many people as suffer from tuberculosis and forty times as many as suffer from infantile paralysis; yet until recently the general public has taken little interest, financial or otherwise, in the treatment and cure of rheumatic diseases. Glowing newspaper and magazine reports of the miracles achieved with cortisone and ACTH have done much to change this. Unfortunately this sudden interest in rheumatic and arthritic cures hasn't always been beneficial. Many patients and some physicians have tended to neglect the necessary routine procedures in treating rheumatic diseases in the hope that the miracle drug will soon be available. The authors emphatically state, however, that "No amount of magic medicine, if it were available, would restore destroyed joints and correct deformities."

The American Rheumatism Association has divided diseases of the joints and related structures into eleven classifications: (1) rheumatoid arthritis, (2) degenerative joint disease —osteoarthritis and hypertrophic arthritis, (3) fibrositis, (4) arthritis due to gout, (5) arthritis due to specific infections, (6) arthritis due to rheumatic fever, (7) arthritis due to trauma, (8) neurogenic arthropathy, (9) new growths, (10) intermittent hydrarthrosis, and (11) miscellaneous diseases such as disseminated lupus erythematosus, scleroderma, polyarteritis, etc. Approximately 95 per cent of all chronic rheumatism is covered by the first four headings; consequently these four classifications are given the greatest emphasis in this book.

The authors begin the manual with a general discussion of the problem of arthritis and rheumatism. The main body of the work centers around a discussion of diagnosis and treatment for rheumatoid arthritis, rheumatoid spondylitis, degenerative joint disease, fibrositis, gouty arthritis, and collagen diseases. A chapter on "Cortisone and Adrenocortico-

trophic Hormone (ACTH)" explains just what these two "miracle" drugs can and cannot do. Much of this material is based on the authors' personal experience and observations. Again and again they stress that cortisone and ACTH are valuable chiefly for research in ". . . uncovering knowledge regarding the mechanism of remission." At present these drugs are too scarce and consequently too expensive for widespread use. Only by discovering the secret of remission can researchers hope to develop a substance that will produce anything more than a temporary alleviation from suffering. The final chapter covers the "Prevention and Correction of Deformities." Included are descriptions and suggestions for making various splints and casts. The authors also describe some useful exercises that will help prevent deformity. Suggested aids to the cripple are listed at the end of the book.

This book is admittedly not the complete story on arthritic and rheumatic diseases, but it does give the fundamentals in a clear and concise way. Excellent photographs and roentgenographs accompany the text. The book is dedicated to ". . . the general practitioner, for it is he who first sees these patients with chronic arthritis and has the opportunity to prevent crippling and deformity." Needless to say, the general practitioner will have the greatest interest in and need for this book.

A HISTOLOGY OF THE BODY TISSUES. By Margaret Gillison, Diploma of Bedford Physical Training College; Diploma in Physical Education of the University of London; Member of the Chartered Society of Physiotherapy; Lecturer in Physiology at the I. M. Marsh College of Physical Education, Liverpool. Cloth. Pp. 220, with illustrations. Price $3.50. The Williams & Wilkins Company, Mt. Royal & Guilford Aves., Baltimore, 1950.

The author states that it was her aim in preparing this book to bridge the gap between the brief references to tissues in books on anatomy and physiology and the detailed accounts in histology texts. She has done so admirably, and has in addition provided a book more detailed than the general, often vague and inexplicit, volumes usually used in elementary biology classes, and simpler than the complex ones of advanced courses. Such intermediary books are unusual, and ones as excellently executed as this are rare indeed.

Throughout the book are many diagrams to augment the text. Illustrations at the end of each chapter portray the various tissues dealt with in the respective chapters. At the end of the book is a group of illustrations of sections of organs, included to demonstrate the integration and relationships of the various tissues in the different organs. These illustrations are the most noteworthy part of the book, for instead of the usual photographs, the author has chosen to use original drawings, made directly from micro-preparations. In this way she has been able to emphasize the particular characteristics of the tissue that are under discussion in the text. The drawings show the loving care Miss Gillison put into their preparation, and they were a wise choice for an elementary book.

Designed to meet the needs of students of physiotherapy and physical education, this little book will serve equally well the beginning student in animal biology. It is not written for, nor will it be interesting to, the practicing physician or biologist, since it contains nothing that he has not already learned.

WORLD SURGERY 1950. By Stephen A. Zieman, M.A., M.D., F.A.C.S., F.I.C.S., Abstract and News Editor, Journal of the International College of Surgeons, Abstractor for International Abstracts of Surgery and Surgery, Gynecology and Obstetrics. Formerly Assistant Chief, Bureau of Publications, U. S. Navy Medical Department, and Assistant Editor, U. S. Navy Medical Bulletin. Cloth. Pp. 177, with illustrations. Price $6.00. J. B. Lippincott Company, East Washington Square, Philadelphia, 1950.

From the surgery journals of practically every nation and every language, Zieman has selected and brought together ". . . the newer ideas, newer technics and newer claims for improvement and advancement in the theory and the practice of surgery." The result is a rather remarkable collection of information on more than 280 unique and unusual surgical operations in such varying fields as gastrointestinal surgery, cardiovascular-respiratory surgery, gynecology, obstetrics, orthopedics, genitourinary surgery, neurosurgery and psychosurgery, ophthalmology and otolaryngology, and surgery of the head and neck. The author has also included some material on anesthesiology, radiology, preoperative and postoperative care, blood substitutes, and antibiotics.

The book is written in abstract form. Complete reference is given at the end of each short case study for those who want more information from the original source. Where necessary for better understanding, photographs, roentgenographs, and line drawings from the original article accompany the text. The author's concise writing style and the widely-spaced double column pages contribute to the readability of the book.

"World Surgery" is particularly valuable to the surgeon and student of surgery because it fills a need not met elsewhere. In one volume the author presents up-to-date information on what other surgeons throughout the world are thinking and doing. For the cursory reader this provides an excellent survey; for the specialized reader, an excellent background.

A.M.A. COUNCIL REPORTS. Annual Reprint of the Reports of the Council on Pharmacy and Chemistry of the American Medical Association with the comments that have appeared in the Journal of the American Medical Association. Cloth. Pp. 231. Price $2.00. J. B. Lippincott Company, East Washington Square, Philadelphia, 1949.

This little book of reprints contains those reports of the Council on Pharmacy and Chemistry of the American Medical Association which were authorized for publication during 1949. Most of the reports and editorial comments were previously printed in the *Journal of the American Medical Association*. The volume also contains several reports of lesser importance which were not previously published in the *Journal*. Of greatest interest will be the chapters on "Newer Adrenolytic, Sympatholytic, and Ganglionic Blocking Drugs," "A Status Report on Analeptics," "New Analgesics," "Effectiveness of Chloresium in Wound Healing and Deodorant Effect," "Cancer and the Need for Facts," "Estrogens and Androgens in Mammary Cancer," the report of the Council on Pharmacy and Chemistry, "Methods of Clinical Study and Evaluation of Therapeutic Agents in Poliomyelitis," and "Progress Without Statistics," a valuable little treatise on the preparation and interpretation of statistical procedures such as are used in controlled clinical trials of new agents in the diagnosis, prevention, and treatment of disease.

THE MERCK MANUAL OF DIAGNOSIS AND THERAPY. Ed. 8. Cloth. Pp. 1,592. Price: Regular Edition, $4.50. Thumb-Index Edition, $5.00. Merck & Co., Inc., Rahway, New Jersey, 1950.

In this, the eighth edition, there are many improvements and additions, but as in any all-embracing reference work, the effects of condensation are apparent. Even 1,570 pages of very fine print are not enough to cover the entire field of medicine adequately. Only the most fundamental information can be given. Still, a compact, all-in-one handbook of diagnosis and therapy of the usual diseases of mankind is frequently valuable for ready reference. For this reason the thumb-index edition is particularly handy.

The Manual has been completely rewritten. Chapters are grouped according to subject matter rather than in strict alphabetical order. The twenty over-all headings are: Allergy; Blood and Lymphatic; Cardiovascular; Deficiency and Metabolic; Dental and Oral; Ear, Nose and Throat; Endocrine; Eye; Gastrointestinal; Genitourinary; Gynecologic and Obstetric; Infectious and Parasitic; Liver and Biliary; Musculoskeletal; Nervous System; Neuropsychiatric and Psychosomatic; Physical and Chemical (including a discussion of such medical emergencies as drowning, burns, poisoning, venomous bites, electric shock, infusion reactions, etc.); Respiratory; Skin and Connective Tissue; and Venereal. A second part of the Manual covers routine immunization procedures, clinical procedures, bedside procedures, preoperative and postoperative routines, diets, office laboratory procedures, alternative proprietary preparations, and various ready reference guides.

New material has been added on the use of penicillin, dihydrostreptomycin, streptomycin, aureomycin, chloromycetin, and bacitracin, crystalline Vitamin B_{12}, and cortisone and ACTH.

TUMOR TOPICS. Edited by R. Lee Clark, Jr., B.S., M.D., M.S. (Surgery), Director and Surgeon-in-Chief, The University of Texas, M.D. Anderson Hospital for Cancer Research; and Russell W. Cumley, B.A., M.A., Ph.D., Editor, The University of Texas, M. D. Anderson Hospital for Cancer Research, Houston, Texas. Cloth. Pp. 120. Price $4.00. Published by The Medical Press of Houston, Texas, through arrangement with The Medical Arts Publishing Foundation, Houston, Texas, 1950.

A compilation of articles that first appeared in the 1948 and 1949 issues of *Cancer Bulletin* and *Texas Cancer Bulletin*, Tumor Topics is concise and to the point. It lends itself to quick perusal—the longest article takes only 10 minutes to read—yet the range of information is complete. Summaries of diagnostic procedures are important inclusions, and reports of numerous clinical conferences make interesting and worthwhile reading. Particularly noteworthy are the discussions concerning those sites of cancer which are often overlooked.

While the book was written primarily for radiologists, it should also provide the general practitioner with new and important knowledge of malignancies.

A. P. Ulbrich, D.O.

REGIONAL DERMATOLOGIC DIAGNOSIS. A Practical System of Dermatology for the Nonspecialist. By Ervin Epstein, M.D., Consultant in Dermatology and Syphilology to the Oakland Area Veteran's Hospital and Mt. Zion Hospital; Consultant to the Tumor Board at the Highland-Alameda County Hospital; Co-Editor of "Dermatologica" ("International Journal of Dermatology"); Abstract Staff of "Excerpta Medica"; Diplomate of the American Board of Dermatology and Syphilology; Member of American Academy of Dermatology and Syphilology and of the Society for Investigative Dermatology; Former president of the San Francisco Dermatological Society; Secretary-treasurer of the Pacific Dermatologic Association; Secretary of the Section on Dermatology and Syphilology of the California Medical Association. Cloth. Pp. 328, with illustrations. Price, $6.00. Lea and Febiger, Washington Square, Philadelphia 6, 1950.

The specific purpose of this text is to aid the general practitioner in describing and diagnosing cutaneous diseases according to their location on the body.

The text is organized according to regions of the body (scalp, forehead, hands, etc.), with one chapter devoted to each region. Each chapter is subdivided into types of dermatoses: inflammations, granulomas, and tumors. Under these subheadings, the diseases characteristic of the local area under consideration are listed according to their frequency of occurrence. Also, at the end of each chapter a summary is given, with descriptions of the diseases covered in that chapter, associated lesions, most important diagnostic features, and tests which may be performed as aids to diagnosis. Thus, by merely identifying the location and characteristics of a dermatosis, the general practitioner using this book should be able to make at least a probable diagnosis. The author suggests that approximately 75 per cent of cases can be correctly diagnosed in this manner, but this, in the reviewer's opinion, is a conservative estimate.

Most of the dermatopathies outlined in this work are frequently encountered in general practice. Descriptions of a few uncommon cutaneous diseases are also given for the physician who prefers to make a tentative diagnosis before referring his patient to a specialist.

Since the book is primarily concerned with diagnosing dermatoses, suggestions as to treatment are rather brief. However, there is an appendix included, giving common lotions, ointments, and other preparations that might be prescribed for the dermatopathies presented in the text.

This work was not intended as a substitute for a standard text on dermatology, nor would it serve that purpose well. But used as a synopsis, in conjunction with a more complete text, or used by itself as a handy reference book, it would be of great value, particularly to students who are beginning their internships or to those physicians just starting out in practice.

A. P. Ulbrich, D.O.

ASPHYXIA NEONATORUM. Its relation to the Fetal Blood, Circulation and Respiration and Its Effect upon the Brain. By William F. Windle, Ph.D., Sc.D., Professor of Anatomy and Chairman of the Department of Anatomy, School of Medicine of the University of Pennsylvania, Philadelphia, Pennsylvania. Cloth. Pp. 70 with illustrations. Price $2.00. Charles C Thomas, Springfield, Ill., 1950.

This is another monograph in the American Lecture series. Most of its content is fetal physiology that is basic to understanding the clinical condition which gives the book its title. A large portion of the material was included in "Physiology of The Fetus," published by Windle in 1940, but he has improved the material with the addition of almost fifty current references.

Windle's subtitle adequately describes his book, but several salient practical points are worthy of mention. The author shows rather conciusively the advantages in clamping the umbilical cord after separation of the placenta instead of immediately upon birth or after cessation of umbilical cord impulses. This provides the infant with about one fourth more blood volume and in effect is a red blood cell transfusion.

By reporting a number of fascinating in utero experiments, the author offers proof of the theory of separate streams of blood in the fetal right atrium, a supposition often discounted.

He quotes recent research, much of it his own, to prove the effect of asphyxia on the brain of the fetus, describing its immediate spastic motor phenomena, its pathological effects on brain and cord as revealed in studied sections, and its effect on learning in cases where other obvious symptoms were lacking. His thesis that asphyxia at birth may be responsible for much of our "inferior human mentalities" is deserving of deep and considerable thought.

Windle's monograph is an excellent piece of work. Even those who are familiar with his previous book may profit from the newer studies and greater compactness of this one. No obstetrician or pediatrician should fail to utilize its good sense. It goes without saying that the basic scientists—pathologist, physiologist, and anatomist—will find it worth while.

Arnold Melnick, A.B., M.A., D.O.

THE OTHER SIDE OF THE BOTTLE. By Dwight Anderson. Price $3.00. A. A. Wyn, Inc., 23 W. 47th St., New York 19, 1950.

In this book the author uses autobiography as a framework on which to hang much of historical medical and scientific interest. Having recovered himself from alcoholism before Alcoholics Anonymous came into being, he can assess its sphere in a detached manner. As executive secretary of the New York State Medical Society he is in a position to obtain first hand information on medical and psychiatric progress in the treatment of alcoholism. He has correlated and condensed his gleanings in a most interesting narrative. In chapter two he establishes an identity with alcoholics and follows this in chapter three with the identification of alcoholics. In chapter four he attempts to answer the question of "why" an alcoholic and continues through chapters five to eight to show some similarities of personality but concludes there is no type. Widely held notions of the physical effects of alcohol are shattered.

Aversion treatment is traced from its infancy through the quack era to its present period of respectability. In much the same manner the various emotional appeals are followed and psychiatric approaches summed up. There is a brief history of the Washingtonian movement and the Emanuel movement and their impact on society. Description of Dr. Turner's Inebriate Asylum, an early attempt to enlist the state's aid in treating alcoholism as an illness, precedes a sketch of the Research Council on the Problems of Alcohol and of the Yale Plan.

The book provides an insight into the problems attendant on alcoholism and the facilities presently available for meeting them.

Using his own story and episodes from other case histories as examples to highlight his thesis, the author achieves a dramatic and appealing text useful alike to the alcoholic and to those upon whom they depend for help.

Leonard V. Strong, Jr.